CHAPTER 4
CUMULATIVE EFFECTS

4.1 BACKGROUND AND REGULATORY FRAMEWORK

The National Environmental Policy Act (NEPA) requires evaluation of a proposed action's potential to contribute to "cumulative" environmental impacts. A cumulative impact is defined as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative impacts can result from similar projects or actions, as well as from projects or actions that have similar impacts (40 CFR 1508.7).

The Montana Environmental Policy Act (MEPA) defines cumulative impacts as "the collective impacts on the human environment of the proposed action when considered in conjunction with other past, present and future actions related to the proposed action by location or generic type" (75-1-220(3), Montana Code Annotated [MCA]). Related future actions may only be considered under MEPA when these actions are under concurrent consideration by any agency through pre-impact statement studies, separate impact statement evaluations, or permit processing procedures (75-1-208(11), MCA). The Montana Department of Environmental Quality (MDEQ) considers cumulative impacts when making the findings under the Major Facility Siting Act (MFSA) (Administrative Rules of Montana [ARM] 17.20.1604 (1) (b) and 1607 (1) (a) (vii)).

Pursuant to ARM 17.4.627, whenever a state agency prepares a joint environmental impact statement (EIS) that must comply with NEPA and MEPA, the joint document must be prepared in compliance with both statutes. The state agency may accede to and follow more stringent federal requirements, such as additional content. NEPA requires reasonably foreseeable future actions to be included in the cumulative impacts analysis, not just those undergoing concurrent review.

This evaluation of potential cumulative effects from the proposed action is consistent with the following regulations and guidance:

- Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Part 24 1500-1508)
- U.S. Environmental Protection Agency (EPA) Procedures for Implementing the Requirements of the CEQ on NEPA (40 CFR Part 6)
- CEQ's *Considering Cumulative Effects under the National Environmental Policy Act*, January 1997
- EPA's *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, EPA 315-R-99-002/May 1999
- *Bureau of Land Management National Environmental Policy Act Handbook*, H-1790-1, 2008
- *Forest Service Handbook, 1909.15*

For this analysis, similar projects that could result in cumulative impacts are such projects as transmission lines over 69 kilovolts (kV); mining operations; aviation facilities, roads, and subdivisions; aviation facilities; and large-scale disturbance actions such as grazing, agriculture, and forest fire. In addition, projects related to the implementation of the Mountain States Transmission Intertie (MSTI), such as new wind developments, are also considered.

The objective of this analysis is to evaluate the significance of the proposed action's contribution to cumulative environmental impacts. The cumulative impact analysis is accomplished in three steps:

- *Step 1*. Identify the cumulative impacts study area for each resource evaluated.
- *Step 2*. Identify and describe past, present, and reasonably foreseeable future actions in the cumulative impact study area that are similar to the proposed action or have substantial impacts to which the proposed action would contribute.
- *Step 3*. Evaluate the potential for the proposed action to have a substantial contribution to cumulative environmental impacts with the potential to significantly affect the environment.

The proposed project alternatives pass through many jurisdictions. Consistent and reliable data are not available across the entire project area for some of the project types that are investigated in this section; for this reason, some of the cumulative effects analysis is, by necessity, qualitative. While specific locations of some potential cumulative effects cannot be identified because there is a lack of consistent and reliable data, this section presents the results of a diligent attempt to identify where these locations may be and by what mechanisms these impacts would occur. The discussion in this section assumes that the selected alternative is one of the action alternatives and a transmission line is built. If the agencies select the no-action alternative, no cumulative effects will occur.

4.2 CUMULATIVE IMPACTS STUDY AREA AND TIMEFRAME

For the purposes of this analysis, the temporal extent of the projects to be considered is the expected physical operational service life of the proposed project. For federal land, the authorization for MSTI would be 30 years (50 years for the U.S. Department of Agriculture Forest Service [USFS]) with an option to renew; for state land, the authorization is in perpetuity; for private land, the easement is negotiable and would vary by landowner. An estimated 10 years will be needed for substantial site rehabilitation after decommissioning is completed when and if that occurs. For past projects that were single-event activities (e.g., timber sales), the temporal extent of this analysis into the past is 30 years. The rationale for this extent is that research has indicated that an average time of recovery from timber harvest in the Northern Rockies is 30 years (Callahan 1996). Past and present events and projects are identified, and their ongoing impacts discussed. "Reasonably foreseeable actions" are proposed projects or actions that have applied for a permit from local, state, or federal authorities and which are publicly known.

The spatial extent of the cumulative effects study area varies in size and shape according to the characteristics of the resource topic being analyzed. The study area for each respective resource is as presented in Table 4-1. Because the proposed project may convey electricity from projects that are far removed from the transmission line itself, some resource discussions below consider projects that are outside of the stated analysis area.

Table 4-1. Cumulative Impact Analysis Area by Resource

Resource	Definition of Cumulative Impact Area	Rationale for Area
Air Quality	Analysis Zone Boundaries	Zone boundaries (Figure 2-1) provide a conservatively large cumulative impact analysis area because most air quality impacts would be localized to a distance of less than 1 mile from construction activities.
Visual	The rights-of-way (ROW) of the alternatives being considered, plus the viewsheds of the proposed facilities, extending out to a distance of 3 miles.	To encompass the area within which the project changes could have the potential to have a substantial effect on visual conditions.
Cultural	The 500-foot physical impact corridor (either side of centerline). A broader, viewshed analysis was considered for visual impacts to cultural resources.	Physical impacts to cultural resources are readily surmised from the known preexisting ground-disturbing developments that occur within this corridor. A viewshed captures other projects that may be visible to an observer within the same viewshed as the proposed project alternative.
Environmental Justice	The cumulative impact area for environmental justice includes the concentrations of populations of concern in the census blocks that are within 6 miles (either side) of the proposed project route, where the proposed project route is likely to coincide with other reasonably foreseeable projects or actions.	Cumulative impacts related to environmental justice would impact populations of concern living close to the proposed project; to impose cumulative impacts, reasonably foreseeable projects would have to adversely impact these same populations.
Socioeconomics	The cumulative impact area for most socioeconomic variables includes the counties through which the proposed project would cross, and the surrounding counties within the same regional labor market, where the proposed project route is likely to coincide with other reasonably foreseeable projects or actions. For cumulative impacts related to electricity markets and prices, the cumulative impact area would extend beyond the local and regional areas, to encompass the western states connected to the same electricity market with which the proposed project and other reasonably foreseeable projects would interact.	Cumulative impacts related to socioeconomic variables, such as jobs, incomes, housing, and ecosystem services, would arise if other reasonably foreseeable projects produced similar impacts or imposed similar demands on the same resources that the proposed project would impact. Cumulative impacts that arise from changes in the supply of electricity would cover a greater area because they would have the potential to affect the market for electricity throughout the western United States.
Vegetation	Based on watersheds; 4th field hydrologic unit codes[1] (HUC).	Considers landscape processes and impacts affecting vegetation, including the cover types described in the

[1] A HUC is a is a geographic area representing part of all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature is a geographic area representing part of all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature

Table 4-1. Cumulative Impact Analysis Area by Resource

Resource	Definition of Cumulative Impact Area	Rationale for Area
		document, rangeland health, noxious weeds, and special status plant species.
Special Status Plants	20 miles on either side of the proposed centerline for all zone alternatives.	Potential to damage sensitive plant populations or reduce habitat available for plants
Noxious Weeds	1 mile on either side of the proposed centerline for all zone alternatives.	Area in which introduction or spread of weeds from this project could interact with weeds already present or introduced or spread by other projects.
Watershed and Wetlands	Analyzed at the watershed scale. 4th field HUCs for wetlands and 6th field HUCs for watershed effects.	Considers landscape scale processes and impacts to riparian/wetland areas and water quality.
General Wildlife	2 miles on either side of the centerline for all zone alternatives.	This area would not likely include entire home ranges of some wide-ranging wildlife species or large contiguous blocks of wildlife habitat; however, as the distance between projects and associated habitat disturbance increases, so decreases the contribution to cumulative effects.
Big Game	Mapped blocks of winter range that intersect with zone alternatives.	Important winter range for big game species has been identified and mapped in both Montana and Idaho. In some cases, mapped winter range extends beyond the 2-mile buffer established for general wildlife.
Migratory Birds and Raptors	2 miles on either side of the centerline for all zone alternatives. To include full extent of mapped waterfowl use areas and raptor management areas where such areas extend beyond 2 miles from the centerline.	2-mile buffer encompasses anticipated home range of nesting pairs for majority of bird species. Mapped waterfowl use areas and raptor management areas are considered regionally important; may extend beyond the 2-mile buffer, and should be included in cumulative effects analysis.
Fish	6th field HUCs.	Direct effects to fish are limited to construction of roads. Indirect effects of other actions within the watershed could contribute to cumulative impacts to fish resources through changes in habitat, water quality, and water supply.
Greater Sage-Grouse (Montana)	Core and occupied habitat areas crossed by the proposed project.	Core areas as well as occupied habitats have been mapped by Montana Fish, Wildlife and Parks (MFWP) and delineate the important habitat for greater sage-grouse in Montana.

Table 4-1. Cumulative Impact Analysis Area by Resource

Resource	Definition of Cumulative Impact Area	Rationale for Area
Great Sage-Grouse (Idaho)	Key habitat areas crossed by the proposed project.	Occupied habitat areas have been mapped by the Idaho Department of Fish and Game (IDFG) but not divided into seasonal use or ranked on levels of importance as of this time.
Geology	1 mile on either side of the proposed centerline for all zone alternatives.	Impact restricted to immediate project area and associated roads.
Paleontology	1 mile on either side of the proposed centerline for all zone alternatives.	Potential for impact to fossil-bearing formations associated with infrastructure construction and roads.
Soils	1 mile on either side of the proposed centerline for all zone alternatives.	Impact restricted to immediate project area and associated roads.
Land Jurisdiction	Bureau of Land Management (BLM): Field Office USFS: Ranger District Private: County	Level at which land use regulation is analyzed, written, and enforced by the agency.
Residential Use	300 feet on either side of the centerlines	Montana sets an electric field limit of 1 kilovolt per meter (kV/m) at the edge of all transmission line ROW in residential areas and an audible noise limit of 50 dBA (A-weighted decibel) at the edge of the ROW in residential and subdivided areas. The ROW is 110 feet on either side of centerline; a 190-foot buffer was added for margin of error (buffer total equals 300 feet).
Agricultural Use	Irrigated and dryland agricultural areas that would be directly disturbed by or would remain in the project footprint.	Cumulative impacts related to land use in these areas would be limited to those locations directly crossed by an alternative.
Parks, Recreation, and Special Designation Areas	Parks, Recreation, and Special Designation Areas that would be directly disturbed by the project footprint.	Cumulative impacts related to land use in these areas would be limited to those locations directly crossed by an alternative.
Transportation and Access	Airports within 3.78 miles (20,000 feet) of centerlines. Length of new roads to be constructed for alternatives; distance from centerline varies.	Denotes Federal Aviation Administration airspace rules; Subpart B, Section 77.13. Provides comparison of cumulative impacts due to road construction.

4.3 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Information about past, present, and reasonably foreseeable future actions in the project area was gathered from land management agencies, field surveys, adopted plans, maps, publicly available datasets, and environmental documents. Amendments to land use plans (LUP) that result in lower standards for visual or other resources may increase the likelihood that future projects will follow a similar corridor as the proposed project. The precise locations and types of these projects are unknown at this time.

The sections below present the past, present, and reasonably foreseeable actions considered in this analysis.

4.3.1 Transmission Lines and Generation Facilities

The following discussion focuses on high-voltage transmission lines (greater than 69 kV) and generation from natural gas plants and wind. Other types of generation facilities (such as coal and hydroelectric) are not known to be associated with the proposed project at this time. Figure 4-1 shows all transmission lines with a capacity of 69 kV or greater within the region through which the project is being proposed. Table 4-2 shows the miles of these transmission lines (defined as those greater than 69 kV) within a quarter mile of each zone alternative. Table 4-3 lists the other potential transmission lines considered in the following analysis of cumulative impacts.

Table 4-2. Transmission Lines in Proximity to Proposed Project Alternatives

Zone Alternative	Miles of Existing High-Voltage Transmission Line (69 kV or greater) within Quarter Mile of Proposed Project Alternatives
1A	12.7
1B	81.9
1C	162.0
1D	31.4
2A	103.0
2B	102.5
2C	52.5
2D	26.5
2E	2.1
3A	41.8
3B	30.3
3C	19.6
4A	20.5
5A	86.7
5B	67.8
5C	66.8
5D	43.2
6A	41.9

Table 4-3. Reasonably Foreseeable Transmission and Generation Facilities

Project Type	Project Name	Portion of the Proposed Project Area Where Cumulative Effects Could Occur	Description
Transmission Lines	Chinook 500-kV high-voltage direct current (HVDC)	Montana/Idaho in areas along MSTI alternatives. The location of Chinook is unknown at this time; however, these two projects would most likely be near each other through the Jefferson Valley and along the I-15 corridor from near Dillon to near Idaho Falls.	Project in early stages of planning. Being proposed by TransCanada. Alternative routes have not been made public. Line may run from near Harlowton, Montana, to Las Vegas, Nevada depending on the location of shippers and customers. It is conceivable that the Chinook line could be in the vicinity of MSTI in numerous locations, depending on final route chosen for both projects.
Transmission Lines	NorthWestern Energy Collector System	The only location that MSTI and this project would have the potential to have cumulative effects would be in the vicinity of the Townsend Substation.	230-kV system of transmission lines to tie generating facilities (most likely wind farms) to the Townsend Substation (northern terminus of MSTI). Locations of these new lines have not been made public at the time of release of the EIS.
Transmission Lines	Gateway West	The only place that MSTI and Gateway West would have the potential to have cumulative effects would be in the area between Borah and Midpoint (Gateway Segment 6).	Gateway West is a 1,200-mile-long transmission line being proposed by PacifiCorp. An EIS is being prepared for this project with the Draft EIS expected in late 2010. Segment 6 of Gateway West is in roughly the same corridor as Alternative 6A. This segment for Gateway is not a new transmission line but simply an upgrade of an existing 345-kV to 500-kV line.
Transmission Lines	Overland	Borah to Midpoint	A 500-kV transmission facility proposed by Jade Energy Associations, LLC; spanning from Chugwater, Wyoming, to the Midpoint Substation near Jerome, Idaho (following the proposed Gateway West route). The application was received on February 26, 2009. The Wyoming BLM State Office is currently reviewing the application.

Table 4-3. Reasonably Foreseeable Transmission and Generation Facilities

Project Type	Project Name	Portion of the Proposed Project Area Where Cumulative Effects Could Occur	Description
Transmission Lines	Zephyr 500-kV HVDC	Borah to Midpoint	A 500-kV electric transmission facility with a tentative load capacity of 3,000 megawatts (MW) proposed by TransCanada; spanning from Glenrock, Wyoming, to Las Vegas, Nevada (following along the proposed Gateway and Southwest Intertie Project [SWIP] routes). An initial application was received by the Wyoming State Office in July 2006, but the application needed revision and has been on hold. See http://www.transcanada.com/company/zephyr_chinook.html for more information.
Transmission Lines	SWIP	Midpoint Substation	A 500-kV transmission facility proposed by Great Basin, LLC, spanning from the Midpoint Substation near Jerome, Idaho, to Las Vegas, Nevada. This project was granted a ROW authorization by BLM in 1994. The company's target in-service date for the Idaho portion is 2011. See http://www.swipopenseason.com/index.htm for more information.
Transmission Lines	Wind Spirit Transmission Lines	The only location that MSTI and this project would have the potential to have cumulative effects would be in the vicinity of the Townsend Substation.	Estimated 1,000 miles of high-voltage transmission line along with a pump storage facility to gather and augment wind energy from eastern Montana, Alberta, and North Dakota. In the early planning stages. Not currently known if or where the Wind Spirit lines would be located.

Table 4-3. Reasonably Foreseeable Transmission and Generation Facilities

Project Type	Project Name	Portion of the Proposed Project Area Where Cumulative Effects Could Occur	Description
Pipeline	Sunstone	Borah to Midpoint	A 42-inch natural gas pipeline facility proposed by Williams Gas Pipeline Company, LLC and TransCanada PipeLine USA Ltd; spanning from Opal, Wyoming, through southern Idaho, to Stanfield, Oregon. The company is re-evaluating the scope and timing of the project to meet the needs of the shippers; they hope to move forward with the project at a later date with a target in-service date of 2012. For more information, see http://www.williamsenergy.com/sunstone_pipeline/ .
Pipeline	Bronco	Borah to Midpoint	A 24- to 36-inch natural gas pipeline facility proposed by Spectra Energy, spanning from Colorado to Oregon, crossing through the southern portion of Idaho. No BLM activity on this project for more than a year, although the company just completed an Open Season to try to secure energy customers in January/February 2009. See http://www.spectraenergy.com/news/releases/2008/Jan/20080110_01.asp for more information.
Generation	Mill Creek Generating Station	Anaconda area	150-MW gas-fired generating station currently under construction.
Generation	Generating facilities made feasible due to additional transmission capacity	Wind farms or additional other generating facilities could be developed as a result of the increased transmission capacity provided by MSTI. No specific projects known to be currently associated with MSTI.	Varies.

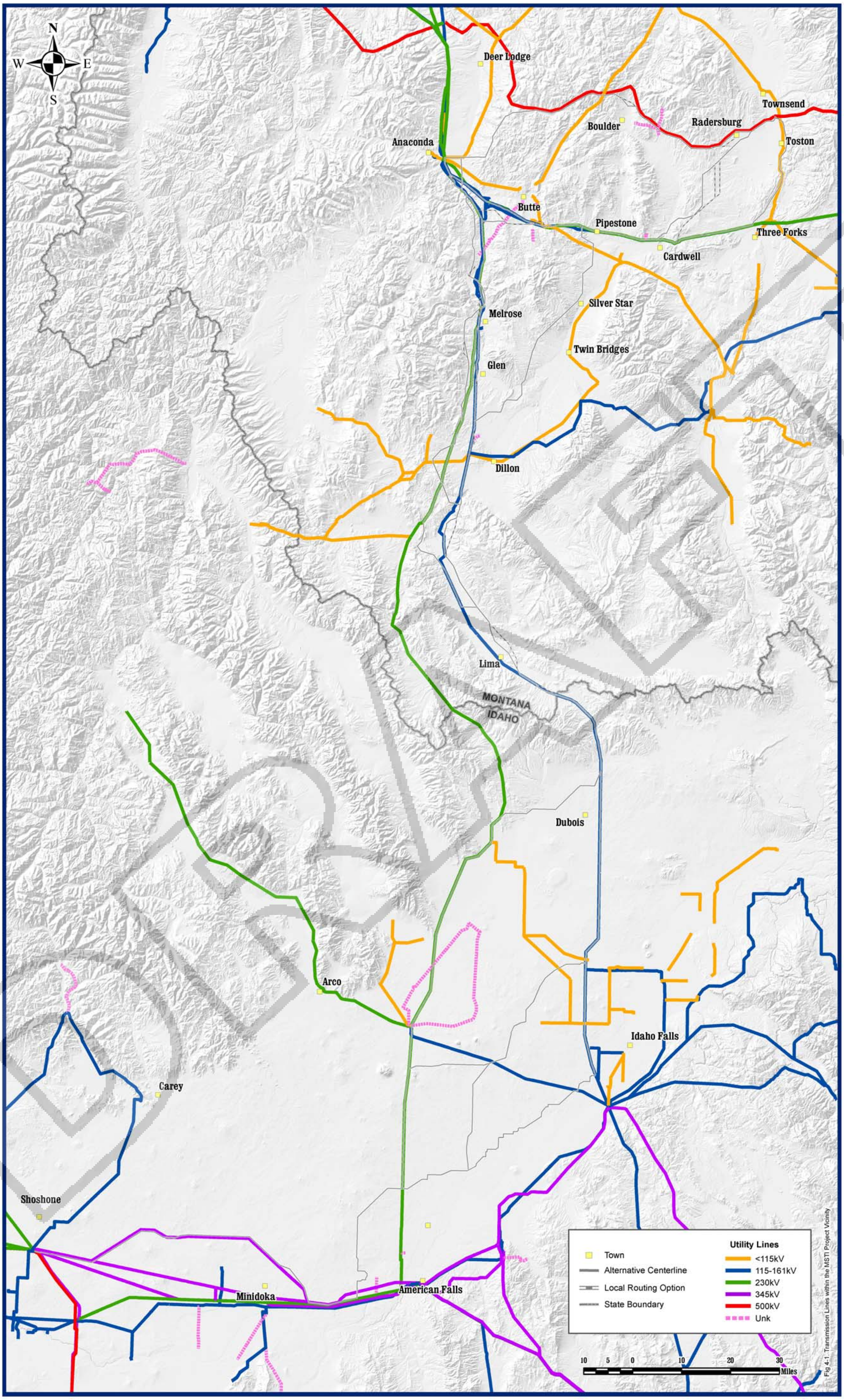

Figure 4-1. Transmission Lines within the Proposed Project Vicinity

Because it is anticipated that the proposed project would transmit power from Montana to other markets, there is the potential that construction of the project would facilitate, but not cause, new generation to be developed in Montana. Because the proposed project is not likely to affect the development of generation facilities in Idaho or elsewhere, the tabulation of existing projects and consideration of new generation projects has been limited to Montana. The rationale for this is that the only proposed substations for MSTI are Townsend, Montana (the location where southbound power would be placed on the line), Mill Creek, Montana, and Midpoint, Idaho (the southern terminus). Power from generation facilities in Canada, Wyoming, or locations east of Montana could also potentially use MSTI to transmit electricity to southwestern load centers; however, none of the facilities in these locations are known to be associated in any way with proposed project.

Two new gas-fired generation projects are currently being constructed or considered in Montana: (1) NorthWestern Energy's Mill Creek gas-fired generation plant that is currently under construction, and (2) Southern Montana Electric's gas-fired Highwood Generation Station, which is in the design phase. These projects are targeted at loads in Montana rather than for export.

Many wind generation projects are currently under consideration in Montana (Table 4-4), and most of these would target markets outside of Montana. Montana wind generation projects currently in the planning phases could total several thousand MW. The proposed project is one of the transmission lines being considered by wind developers to move wind-generated electricity to out-of-state markets.

For purposes of cumulative impact assessment from wind farms, it is conservatively assumed that:

- The MSTI line capacity would be 1,500 MW north to south and 950 MW south to north.
- New wind farms would be built to use about 950 to 1,500 MW of capacity in the north to south direction.
- Turbines with individual capacities of 1.5 to 2 MW would be used.

Accordingly, 480 to 1,000 turbines could potentially generate electricity that would be transmitted on the MSTI line. The precise locations of the wind farms that should be included in this cumulative effects analysis are not currently known because NorthWestern has not received firm contracts from shippers to use the proposed project. It is therefore not well-established that the potential wind development (480 to 1,000 turbines) mentioned above is truly a "reasonably foreseeable action." However, in an effort to provide a range of potential cumulative effects, the following discussion considers the general types of impacts that may occur as a result of construction of between 950 MW and 1,500 MW of wind turbines that would use between 60 to 100 percent of the capacity of the proposed project.

The cumulative impacts analysis for potential wind farms is heavily adapted from the *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM Administered Lands in the Western United States* (BLM 2005b) and refined for conditions generally found east of the continental divide in Montana. Because of the lack of detailed plans for wind farms, site-specific issues associated with individual wind farms are not assessed in detail; rather, the range of possible impacts is identified. The BLM EIS includes an extensive list of potential mitigation measures to reduce or eliminate impacts. These potential mitigations could be refined for conditions in Montana east of the continental divide.

Many commercial wind farms are using individual turbines with a generating capacity of 1.5 MW to 2 MW. Development of a wind farm is likely to involve establishing site access, constructing roads, removing vegetation, excavating, constructing towers, and installing turbines, control buildings, meteorological towers, substations, and transmission lines.

Table 4-4. Existing and Proposed Wind Developments in Montana

Montana Wind Project List		Existing or Proposed
Size (MW)	**Site**	
10	Norris Hill	P
80	Springdale	P
1,500	Near Great Falls	P
9	Near Great Falls	E
180	Cut Bank area	P
135	Judith Gap	E
52.5/82.5	East of Martinsdale	P
19.5	Baker	E
10	Baker	E
37.8	Teton Ridge	P
0.195	Livingston	P
300	Near Shelby	P
20	Norris Hill	P
75	Martinsdale	P
57/500	Martinsdale	P
0.5	Martinsdale	E
0.715	Martinsdale colony	E
2	Martinsdale colony	E
0.455	Two Dot	E
10	Wheatland County	P
50/396	North of Reedpoint	P
120	Cut Bank	P
50/170	Valley County	P
60	Whitehall	P
149	Norris Hill	P
210	Near Shelby	E
150	Near Shelby	P
250	Near Shelby	P
200	Near Great Falls	P
500	Judith Basin	P
140	Near Great Falls	P
500	Various locations	P
100	Crow Reservation	P
65	Northern Cheyenne Reservation	P
100	Fort Peck Reservation	P

Source: Tom Kaiserski, Montana Department of Commerce (May 12, 2010)

Construction may take less than a year to several years. Access roads would typically be a minimum of 10 feet wide or as much as 30 feet wide. Existing public or private roadways may be altered to accommodate heavy or oversized vehicles. Based on experience, the final footprint for the aboveground facilities is likely to be no more than 10 percent of the total acreage of the wind farm site (BLM 2005b). Approximately 2.15 acres would be disturbed per turbine (BLM and DNRC 2007) for 1.5 MW turbines.

During wind farm operation, maintenance crews of between 6 and 15 people would likely work at larger sites (Steinhower 2004); smaller sites may have people on call. Maintenance includes inspection, lubrication, painting, or major overhauls. Technological advances may lead to replacing turbines or blades for efficiency. Facilities may be removed and recycled when no longer needed. If decommissioning occurs, disturbed land areas could be restored to original grade and reseeded or replanted. During dismantling of electrical substations and storage buildings, the site could be inspected for industrial contamination from minor spills or leaks and decontaminated as necessary.

4.3.2 Mining

For details on existing (past and present) mining facilities in the vicinity of the proposed project alternatives, see Sections 3.6.2 and 3.6.3. No new mining facilities are known to be planned within the cumulative effects analysis area.

4.3.3 Aviation Facilities

For details on existing aviation facilities in the vicinity of the proposed project alternatives, see Sections 3.6.2 and 3.6.3. No aviation facilities are known to be planned within the cumulative effects analysis area.

4.3.4 Roads and Subdivisions

Figure 4-2 shows all roads in the region through which the project is being proposed. Table 4-5 lists the miles of all roads within a quarter mile of each proposed project alternative route. This analysis considers all roads including interstate highways, county roads, state roads, and “forest roads.” The data were gathered through aerial photo interpretation and publicly available data sets.

The Montana Department of Transportation, the Idaho Transportation Department, and the county public works departments have no plans to construct major new roads in the project area; however, these entities do plan continued maintenance and upgrading of the existing roadway infrastructure (e.g., widening of U.S. Highway 287 south of Townsend). It is also reasonable to assume that smaller, private roads would be constructed within the project area to serve new developments. These potential future projects would likely be constructed by private developers extending new local access roads to future development, or upgrading existing dirt roads to higher standards. Because of the speculative nature of such activities and the absence of actual physical plans, potential land disturbance from future local road construction and maintenance activities cannot be quantified reliably across the project area at this time. Existing known subdivisions are described in Sections 3.6.2 and 3.6.3. Other land development activities are likely to occur in the future; however, precise locations and extents of these developments are not known at this time.

Table 4-5. Mile of Existing and Proposed Roads in Proximity to Proposed Project Alternative Routes

Zone Alternative	Miles of Existing Roads within a Quarter Mile of Zone Alternative	Miles of New Roads within Quarter Mile of Zone Alternative
1A	116.8	68.5
1B	134.2	79.9
1C	179.2	71.5
1D	63.6	53.4
2A	132.9	30.3
2B	124.4	47.1
2C	119.9	90.7
2D	80.8	71.1
2E	49.3	64.1
3A	118.3	51.0
3B	88.4	81.7
3C	87.8	84.4
4A	32.9	14.6
5A	208.9	21.3
5B	220.1	31.8
5C	186.8	47.2
5D	188.2	44.1
6A	143.1	83.5

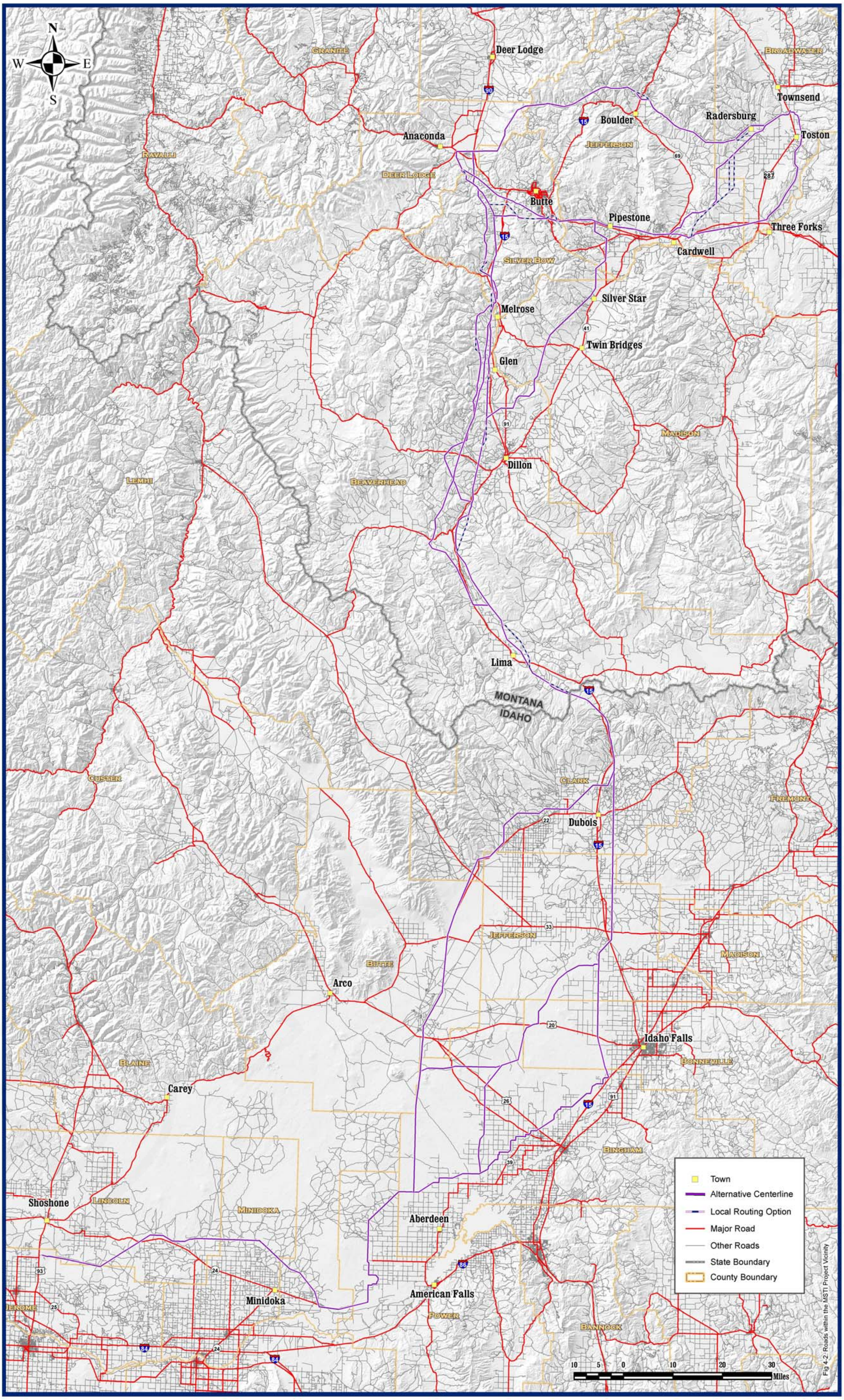

Figure 4-2. Roads within the Proposed Project Vicinity

4.3.5 Forest Modification

This category of activity includes fire, timber harvest, and mountain pine beetle mortality. Both wildfire and prescribed burning activities have occurred throughout history and prehistory within the project area. The data that are available on the locations and severity of these fires is inconsistent across ownership types. The level of inconsistency precludes the use of the data on any reliable landscape level analysis such as is required in cumulative effects. Nevertheless, it is known that all of these agents of forest modification (fire, timber harvest, and mountain pine beetle) have had a substantial impact on natural resources within the cumulative effects analysis area. They are, therefore, considered in the relevant resource analyses below.

The Schedule of Proposed Actions (SOPA) for the Beaverhead-Deerlodge National Forest (BDNF) is at http://www.fs.fed.us/sopa/forest-level.php?110102. According to the version that describes proposed activities from January 2010 to March 2010, two ground disturbing activities could potentially interact with one or more alternatives to bring about detrimental cumulative effects:

- *East Deer Lodge Valley Landscape Restoration Management Project*. The proposal involves restoration of terrestrial and aquatic conditions, response to 2008 landscape assessment, capture economic value of dead/dying trees, and implement other USFS strategies.
- *Homestake Pass Salvage and Restoration*. The proposal involves salvage of dead and dying lodgepole pine affected by mountain pine beetle on about 272 acres, maintenance of grass/shrub/aspen community by slashing and burning of encroaching conifers on about 593 acres, and Lion Gulch riparian habitat and stream channel restoration.

See http://www.fs.fed.us/sopa/components/reports/sopa-110415-2010-01.pdf for the SOPA for the Caribou-Targhee National Forest (CTNF). The Web site shows no proposed activities on the Dubois Ranger District that would be within the cumulative effects analysis area.

BLM-proposed activities are catalogued in what are referred to as NEPA logs, available at the following Web sites:

- For Idaho, http://www.blm.gov/id/st/en/info/nepa.html
- For Montana, http://www.blm.gov/mt/st/en/info/nepa.html

These logs show no proposed activities within the cumulative effects analysis area that would be relevant to this project.

4.3.6 Grazing and Agriculture

Past and present grazing and agricultural activities are described in Sections 3.6.2 and 3.6.3. Grazing and agricultural activities will occur in the future throughout the project area. The areas of these activities are not likely to change from those areas currently under those land uses; however, precise locations of any changes are not known at this time.

4.4 EVALUATION OF POTENTIAL CUMULATIVE IMPACTS

The direct and indirect impacts of the proposed project are analyzed in Chapter 3. The following sections analyze potentially significant cumulative impacts related to the proposed project when viewed in conjunction with other past, present, and reasonably foreseeable actions. This analysis considers the anticipated contribution that the alternatives would have to cumulative impacts after all agency atipulations (Appendix B.4) and mitigation measures described in Chapter 3 are implemented.

4.4.1 Air Quality

Past, present, and reasonably foreseeable projects, including industrial activities (mining, power generation, and manufacturing), grazing and agriculture, road construction, and fires (wildfires and prescribed burning), may have a cumulative effect on air quality in the study area. During the construction phase, the proposed project would add particulate and gaseous emissions to those generated by the existing and proposed activities. After construction, the operation of the proposed project would generate small amounts of ozone from corona activity and particulate emissions from access roads. Particulate emissions from access roads would attenuate with distance and would be further reduced to levels that would not contribute to cumulative impacts to air quality.

Construction of the proposed project would occur in phases over approximately 3 years. Particulate and gaseous pollutants generated during construction would be dispersed both temporally and spatially with any impacts attenuating rapidly with distance.

The potential for proposed project activities to combine with emissions from a nearby source such as the Mill Creek Generating Plant or wind farms that might be built in Montana to create a short-term ambient air quality or visibility exceedance is low. Cumulative air concentration impacts depend on meteorological conditions. Even in cases where proposed project activities would be near other air pollutant emissions sources, cumulative effects would require specific meteorological conditions with limited probabilities of occurrence.

Most of the proposed routes are located in rural areas with low populations, few sensitive receptors, and excellent air quality. In non-attainment areas, existing measures have been instituted to control emissions from contributing sources for the purpose of reducing cumulative impacts. The potential for project-generated emissions to have a cumulatively considerable contribution to degradation of air quality in non-attainment areas is low.

Even without the application of the agency stipulations (Appendix B.4), the amount of particulate and gaseous emissions expected to be generated by the proposed project would be low and would not exceed air quality standards. With the agency stipulations employed to further reduce project-generated air emissions, the proposed project would have minimal impact on local and regional air quality should the project be approved. Cumulative effects on air quality are therefore considered to be less than significant.

4.4.2 Climate Change

Past and present activities in the study area contribute greenhouse gases (GHG) to the atmosphere. The Montana Climate Change Advisory Committee has estimated that GHGs with global warming potential equivalent to 41 million tons of carbon dioxide were emitted in Montana in 2005 (Montana Climate Change Advisory Committee 2007). Fossil fuel consumption accounted for 62 percent of Montana GHG emissions, agriculture accounted for 21 percent, and production of fossil fuels accounted for 14 percent.

The proposed project would emit very small amounts of GHGs, principally from vehicle and equipment operation during transmission line construction. However, generation of electricity by potential wind farms with contracted capacity on the proposed transmission line could help to reduce emissions of GHGs by avoiding the need to generate equal amounts of electricity from fossil fuels. Conversely, one of the other reasonably foreseeable actions identified in the region, the Mill Creek Generating Plant, would contribute to GHG emissions. Operation of the Mill Creek Generating Plant would release an estimated

188,000 tons per year of carbon dioxide (MDEQ 2009), less than one-half percent of Montana's total release of GHGs in 2005.

Global climate change and corresponding shifts in air temperatures and precipitation patterns has the potential to affect numerous environmental resources. Scientific modeling predicts that continued GHG emissions, at or above current rates, would induce more extreme climate changes during the 21st century than were observed during the 20th century. A warming of about 0.36 degree Fahrenheit (°F; 0.2 degree Celsius; °C) per decade is projected (IPCC 2007). Identifiable signs that global warming could be taking place include substantial ice loss in the Arctic (IPCC 2007).

Potential effects of global climate change in the proposed project area may include loss in snow pack, more extreme and more numerous heat days per year, more high ozone days, more large forest fires, and more drought years. Climatic variability is generally expected to increase as a result of the effects of additional GHG emissions (Chambers and Pellant 2008). The proposed project could potentially contribute to this effect. As noted in Chapter 3 under the project-level analysis, the effects of the project cannot be determined because of a lack of quantification capabilities for project-specific contributions to overall rates of change at the regional (climate) scale; therefore, the contribution of the proposed project to the climate change effects cannot be quantified. The sections below summarize some of the potential effects reported by an array of studies that could be experienced in Montana, Idaho, and nationwide as a result of global warming and climate change. The proposed project may contribute to these effects; however, the quantification and determination of the project's contribution is not feasible at this time.

4.4.2.1 Air Quality Impacts Related to Climate Change

Higher temperatures are conducive to air pollution formation that could reduce air quality. Climate change may increase the concentration of ground-level ozone, but the magnitude of the effect, and therefore its indirect effects, is uncertain. If higher temperatures are accompanied by drier conditions, the potential for large wildfires could increase, which would further reduce air quality. If higher temperatures are accompanied by wetter, rather than drier conditions, the rains would tend to temporarily clear the air of particulate pollution and reduce the incidence of large wildfires, thus ameliorating the pollution associated with wildfires (Chambers and Pellant 2008).

4.4.2.2 Water Supply Impacts and Changes in Runoff Regime Related to Climate Change

Great uncertainty remains about the overall impact of global climate change on water supplies. Climate change could potentially affect the amount of snowfall, rainfall, and snow pack; the intensity and frequency of storms; and flood hydrographs (flash floods, rain or snow events, and high runoff events). Changes in storm intensity and frequency could affect the ability of flood-control facilities, including levees, to handle storm events.

As a result of temperature increases, a higher percentage of annual precipitation is falling as rain rather than snow (Chambers and Pellant 2008). As a result, there has been an increase in streamflow variation, and warm season water supplies have declined as runoff rates have increased (Chambers and Pellant 2008). Even assuming that climate change leads to long-term increases in precipitation, analysis of the effect of climate change is further complicated because no studies have identified or quantified the runoff impacts that such an increase in precipitation would have in particular watersheds. Also, little is known about how groundwater recharge and water quality would be affected. Higher rainfall could lead to greater groundwater recharge, although reductions in runoff volumes and higher evapotranspiration could reduce the amount of water available for recharge. Changes in flow regimes and reductions in discharge, coupled with increased water temperatures in summer, would decrease water quantity and quality for aquatic and wildlife species, livestock, and human use (Chambers and Pellant 2008).

4.4.2.3 Ecosystems and Wildlife Impacts Related to Climate Change

Increases in global temperatures and the potential resulting changes in weather patterns could have ecological effects both locally and globally. Increasing concentrations of GHGs are likely to accelerate the rate of climate change. Scientists expect that the average global surface temperature could rise between 1.0 and 4.5°F (0.6 and 2.5°C) in the next 50 years, and 2.2 and 10°F (1.4 and 5.8°C) in the next century, with substantial regional variation (EPA 2000). Soil moisture is likely to decline in many regions, and intense rainstorms are likely to become more frequent. Rising temperatures could have four major impacts on plants and animals: (1) timing of ecological events, (2) geographic range, (3) species' composition within communities, and (4) ecosystem processes, such as carbon cycling and storage. Many ecosystem functions are driven or cued by annual climate cycles. More obvious examples of this include sprouting, flowering, and seed production in plants and animal migration and hibernation. The range of species (both plants and animals) could shift as climatic patterns result in changes to habitats, food sources, soil moisture, and predation. Species are generally expected to shift up in elevation and/or further north. This shift could apply to all species and habitats. Plant communities could change dramatically as moisture patterns change. Communities' composition could shift toward species more adapted for a drier climate or those able to tolerate more fluctuation in conditions. In any situation where there are potentially massive changes in biomass, major ecosystem processes would become unstable.

4.4.3 Wildlife

Cumulative impacts on wildlife and wildlife habitat could potentially occur from the proposed project in conjunction with other past, present, and reasonably foreseeable actions in the defined study area. Possible cumulative impacts would include:

- Temporary and permanent removal of habitat and subsequent displacement of wildlife species
- Temporary or permanent avoidance of power line structures by certain species
- Reduced habitat quality that could affect wildlife populations and distribution across the landscape
- Indirect effects from the increase in human activity in the area, including disruption of wildlife behavior during key periods such as nesting, breeding, young rearing, and overwintering
- Habitat fragmentation, resulting in isolation of wildlife populations and decreased genetic flow between populations
- Wildlife mortality, which could impact hunting and viewing opportunities for the public and potential local extirpations of sensitive wildlife populations

Past, present, and future projects and other environmental stressors including the proposed project that have or may contribute to future cumulative impacts on wildlife and wildlife habitat include roads, transmission lines, pipelines, mineral extraction, timber harvest, grazing, wildfire, subdivisions, exurban expansion, and agricultural activities. While the proposed project and other projects requiring state and federal permits and approvals would be located and built in a manner that would avoid and minimize impacts to important habitats, there would still be residual impacts (as listed above) caused by these projects. When added to past habitat alterations and other future actions, impacts from the proposed project would be considered cumulatively considerable for some wildlife resources.

4.4.3.1 Big Game

Habitat use by big game species in the study area has been at least partially shaped by past and present human activities on the landscape. Important habitat such as big game winter range has been encroached upon and fragmented by roads, utility corridors, development, and other human activities. Some portion of all of the proposed alternatives cross big game winter range as discussed in Chapter 3 and, combined with future projects through the same wintering areas, could result in adverse cumulative impacts in terms of reduced habitat quantity and quality. Because many of the identified wintering areas are large blocks of habitat, big game will not likely be precluded from using these areas altogether as a result of future actions including the proposed project; however, the carrying capacity of the winter range may be reduced as the landscape becomes fragmented and animals choose to avoid habitats close to new roads or other development. Some winter range within the study area is either protected through conservation easements that limit development or occurs within the boundaries of state or federally designated wildlife management areas (or similar designation), which also restrict development within key wildlife habitats.

Each of the BLM Resource Management Plans and USFS Forest Plans has standards (Chapter 5) that guide all actions within lands administered by those agencies. As long as these standards are followed by the proposed project and reasonably foreseeable projects, cumulative impacts to big game should be reduced to less-than-significant levels. Mitigation measures discussed in Chapter 3 have been formulated by specialists in wildlife management in the project area to be effective at reducing impacts to big game species. Applied to the proposed project, those mitigation measures would help reduce impacts to low levels but would not completely eliminate those impacts, especially the removal and fragmentation of habitat. When considering the residual impacts to big game species from MSTI in addition to other past, present, and future actions, impacts from the proposed project would be considered cumulatively considerable.

4.4.3.2 Migratory Birds

The proposed project has the potential to result in residual impacts to migratory birds and raptors through habitat removal, fragmentation, and direct mortality of individual birds during and after construction. Avoidance of known nests and important nesting habitat such as wetland and riparian areas, grasslands, sagebrush communities, and forested areas during the nesting season would greatly minimize residual impacts. In terms of habitat protection during design and construction of the preferred project alternative and other actions in the study area, all known raptor nest sites should be protected as defined in the applicable land management plans. Other future actions on public land would also be required to comply with such standards.

For other past, present, and reasonably foreseeable projects, the number of turbines associated with wind energy development projects has been identified as a major variable associated with potential avian mortality (EFSEC 2003). Erickson et al. (2001) projected a total of 33,000 bird fatalities per year from the estimated 15,000 operating wind turbines (by the end of 2001) in the United States, an average of 2.2 avian fatalities per turbine per year for all species combined. Table 4-6 summarizes reported avian fatality rates at a number of wind energy projects. Local conditions heavily influence mortality at any site; the number of bird fatalities per turbine per year in individual studies ranged from none (at Searsburg, Vermont, and Algona, Iowa) to 7.3 (at Buffalo Mountain Phase I, Tennessee).

Judith Gap Energy Center, located in Wheatland County, Montana, was completed in October 2005. Surveys for the 90-turbine wind energy project were completed during the fall 2006 and spring 2007 migration periods (TRC 2008). Estimated turbine-related fatalities at this wind farm during the study period were 406 birds (4.52 per turbine). Results of this study suggest that avian fatality rates at this wind farm are similar to fatality rates at other wind farms around the U.S.

Based on data collected outside California, the expected avian mortality at wind farms would range from 0 to 4.52 birds per turbine per year. For wind turbines potentially built by developers that might use the proposed transmission line (480 to 1,000 turbines), this would equate to as many as approximately, 2,170 to 4,520 bird fatalities per year.

Fatalities of raptors are of special concern because of their generally low numbers and protected status. Raptor mortality estimates based on data collected from the various wind farms in the United States indicate an average of 0.033 fatalities per turbine per year (Erickson et al. 2001). Except at the Altamont Pass in California, the number of raptors killed at any facility is small (Table 4-6; NWCC 2002). Some California wind farm sites have unusually high raptor fatalities because of topography, high raptor densities, and possibly older turbine technology (Kingsley and Whittam 2003). Excluding California, raptor fatalities were estimated at 0.006 per turbine per year (Erickson et al. 2001) and applied to the possible 480 to 1,000 turbines that might use the MSTI transmission line, between 3 and 6 raptors might be killed annually.

Habitat available for birds could be reduced or modified in wind farms. Both decreases and increases in bird population densities have been reported at wind farms in different areas. In southwestern Minnesota, lower bird population densities were reported in areas that were within 262 feet of the turbines than in control areas and areas that were 591 feet away from turbines (Leddy et al. 1999). A grassland bird displacement study at the Judith Gap Energy Center, however, found that construction of the wind farm did not negatively impact numbers of breeding grassland birds (TRC 2008). Point counts performed before and after construction of that facility showed a 54 percent increase in number of birds detected in the vicinity of the turbines compared to a 20 percent increase in control plots with no turbines. Operation of wind farms could also impact birds through collisions (as discussed above). The cumulative impact of habitat loss as described above could affect some wildlife, particularly grassland-dependent birds.

As discussed in Chapter 3, transmission lines are a known hazard to numerous bird species, including raptors and waterfowl, through collisions with wires. Placement of the proposed transmission line and other future transmission lines over lakes, rivers, riparian areas, and wetlands has the potential to cumulatively add to bird mortality in these locations. An Avian Protection Plan would be developed for the proposed project (to be included in the Plan of Development) to help minimize collision hazards in the study area. This Avian Protection Plan has been formulated by specialists with substantial experience in wildlife mitigation related to transmission lines to have a high likelihood of success. When this plan is implemented, residual impacts to bird species would be reduced to low levels; however, when taken into consideration with the effects on migratory birds from other proposed transmission lines, wind energy development, and other sources of bird mortality, impacts from the proposed project would be considered cumulatively considerable.

Table 4-6. Avian Fatality Rates Observed at Some Wind Energy Projects

Wind Farm	State	Number of Turbines	Bird Fatalities per Turbine per Year[a]	Bird Fatalities per 100,000 m^2 of RSA per Year[a]	Raptor Fatalities per Turbine per Year[a]	Raptor Fatalities per 100,000 m^2 of RSA per Year[a]
Altamont Pass	CA	5,400 (in 2001) 7,340 (in early 1990s)	0.33 to 0.87, .05 to 0.1, 0.19	NA	0.16 to 0.24, .007 to 0. .048, 0.1	9.0 to 22.0 1.0 to 2.0[b]
Buffalo Mountain Phase 1	TN	3	7.3	NA	0	NA
Buffalo Mountain Phase 2	TN	15	1.8	NA	0	NA
Buffalo Ridge (all phases)	MN	354	2.8	161.0	NA	NA
Buffalo Ridge Phase 1	MN	73	0.33 to 0.66, 0.98	NA	.01	NA
Buffalo Ridge Phase 2	MN	143	2.27	NA	0	NA
Buffalo Ridge Phase 3	MN	138	4.45	NA	0	NA
Foote Creek Rim	WY	69	1.5, 1.75	108	.03, .036	3.0, 0,3[b]
Green Mountain (Searsburg)	VT	11	0	0	0	0
IDWGP[c] (Algona)	IA	3	0	0	0	0
Judith Gap	MT	90	4.52	NA	0.14	NA
Klondike	OR	16	1.42	NA	0	NA
Montezuma Hills	CA	600	NA	NA	0.48	NA
Mountaineer Wind Energy Center	WV	44	4.04	NA	0.33	NA
Nine Canyon Wind Energy Project	WA	37	3.59	119.8	.08	2.6
Princeton	MA	8	0	0	0	0
San Gorgonio	CA	2,900	2.31	NA	.01	NA

Table 4-6. Avian Fatality Rates Observed at Some Wind Energy Projects

Wind Farm	State	Number of Turbines	Bird Fatalities per Turbine per Year[a]	Bird Fatalities per 100,000 m^2 of RSA per Year[a]	Raptor Fatalities per Turbine per Year[a]	Raptor Fatalities per 100,000 m^2 of RSA per Year[a]
Somerset County	PA	8	0	0	0	0
Stateline	OR/WA	454	1.7	96,6	.05	NA
Vansycle	OR	38	0.63	38.0	0	0
Wisconsin	WI	31	2.83	73.3	.02	NA

NA = Not applicable (not calculated or appropriate)
RSA = Rotor-swept area
M^2= square-meter

[ab] Multiple values are included if there were results from more than one study.

[b] Golden eagles only.

[c] IDWGP = Iowa Distributed Wind Generation Project

Sources: BLM (2005b); Curry and Kerlinger (2004a,b); Erickson et al. (2001, 2002, 2003a,b); Fiedler et al. (2007); Johnson et al. (2002, 2003a); Kerns and Kerlinger (2004); Osborn et al. (2000); Smallwood and Thelander 2004; Strickland et al., (200la,b); Thelander and Rugge (2001); TRC (2008); Young et al. (2003a)

4.4.3.3 Greater Sage-Grouse

For the purposes of this cumulative effects analysis, the sage-grouse populations in the affected area were defined as the area encompassed by the Dillon Local Sage-Grouse Working Group in Montana and the sage-grouse planning areas in Idaho, as the resource of concern. The combined effect of past actions has resulted in substantial reductions in sage-grouse populations throughout Montana and Idaho as well as those sage-grouse populations in the project area (see Section 3.3 for a detailed discussion of existing sage-grouse populations).

Any of the reasonably foreseeable actions listed above that may result in direct mortality to sage-grouse (e.g., new roads and fences), remove sagebrush in sage-grouse habit (e.g., agriculture and subdivisions), degrade sage-grouse habitat (e.g., improper livestock grazing and noxious weed infestations), or that have the potential to displace sage-grouse or to fragment sage-grouse habitat (e.g., existing and proposed roads, existing and proposed distribution and transmission lines, and wind energy developments) would collectively result in cumulative impacts to sage-grouse unless those impacts are successfully mitigated. It is assumed that some of the electricity supply for the proposed transmission line would come from wind energy development, although the locations of these developments are currently not known. Because sage-grouse evolved in habitats with little vertical structure, placement of structures such as wind turbines in occupied sage-grouse habitat may result in a decrease in habitat suitability (USFWS 2004b).

Several studies have shown that sage-grouse avoid other anthropogenic features such as roads, above-ground power lines, and oil and gas wells (Naugle et al. 2009). Much of the infrastructure associated with wind energy facilities, such as power lines and roads, are common to most forms of energy development and it is assumed that impacts would be similar, although little data are available on response of sage-grouse to wind energy development (Johnson and Holloran 2010). Other sources of energy development for the proposed project may include gas and coal-fired power plants, which also would impact sage-grouse if placed in occupied habitat. Major wildfires are another disturbance that could have detrimental impacts on sage-grouse populations. Wildfire can potentially eliminate large areas of sagebrush within the project area. Some activities, such as fence removal and native vegetation restoration, may improve sage-grouse populations.

To reduce cumulative impacts associated with the proposed project, several measures to avoid and minimize impacts during construction and operation of the project after construction have been developed. In addition, extensive research and monitoring of the affected sage-grouse populations would be conducted to evaluate and quantify any impacts that actually occur (MDEQ 2010). If significant impacts are identified, offsite mitigation may be considered to offset impacts that cannot be avoided (Section 3.3.4). Based on these mitigation measures, none of the proposed build alternatives are expected to singularly result in substantial residual impacts to sage-grouse. However, when combined with other past and present actions that have already reduced sage-grouse populations in the project area, impacts associated with the proposed project and additional future development in the project area could lead to significant cumulative impacts on sage-grouse. Because sage-grouse are federal candidate species, the U.S. Fish and Wildlife Service is required to review their status annually; therefore, if impacts continue to reduce sage-grouse populations, the species could be listed under the Endangered Species Act. If impacts are identified during the research and monitoring studies, successful implementation of offsite habitat enhancements or other mitigation measures would compensate for identified impacts so that cumulative impacts to sage-grouse in the project area are minimized, although not completely eliminated.

Sage-grouse populations are commonly quantified at the scale of the population. This unit of measure can be up to several hundred square miles. The boundaries of these population units through which the proposed project crosses are not delineated; however, it is reasonable to assume that, because there are likely residual impacts (impacts that remain after all mitigation is implemented) from the proposed line, that it will have cumulative effects with some other projects. These impacts occur through two mechanisms: (1) vertical structures may displace and/or result in changes to movement patterns of sage-grouse, and (2) physical destruction of sagebrush habitat. Where impacts from the proposed project are cumulative with other projects is wherever either vertical structures are built or wherever sagebrush habitat is destroyed within the population boundaries.

The residual impacts of the proposed project on sage-grouse are small, and the precise locations of future projects (such as the Chinook transmission line) are unknown. With the data currently available and the scientific knowledge at its current state regarding impacts of vertical structures on sage-grouse behavior, it is concluded that impacts to sage-grouse associated with the proposed project, in addition to other past, present, and future actions, would be considered cumulatively considerable.

4.4.3.4 Bald Eagle

As discussed in Chapter 3, bald eagle nests are located in the vicinity of several proposed project alternatives along major river corridors in Montana including the Missouri, Boulder, Red Rock, Big Hole, Ruby, and Beaverhead. Additionally, bald eagles are known to use seasonal habitat along most route alternatives in Montana and Idaho. Potential impacts from the construction and operation of the proposed project and other transmission lines include disturbance to individual nest sites during construction and the potential for collisions during operation. All proposed projects, transmission and otherwise, located within the anticipated home range of nesting bald eagles would be required to limit construction during the nesting season within a set distance from the nest. Implementation of an Avian Protection Plan for this project and other proposed transmission lines nearby would further minimize potential impacts to bald eagles. Impacts to bald eagles from the proposed project are not considered to be cumulatively considerable.

4.4.3.5 Ferruginous Hawk

Ferruginous hawks may occur in all six zones and have been documented along all route alternatives in Zone 3 in Montana and Zone 5 in Idaho. Potential effects of the proposed project on ferruginous hawks include direct mortality, disturbance, and loss of habitat. Preconstruction surveys would help minimize disturbance to active nests through avoidance and the use of temporal and spatial restrictions on construction within close proximity to nests. The proposed project would, however, contribute to habitat loss for ferruginous hawks in the study area. When considering the residual impacts to ferruginous hawk habitat from this project in addition to other past, present, and future actions, impacts from the proposed project would be considered cumulatively considerable.

4.4.3.6 Pygmy Rabbit

Pygmy rabbits are known to occupy sagebrush habitat south of Dillon along Links 15-2c, 15-2d, and 38 (Appendix C.3.1-17) and in northern Idaho where the species is considered common on Idaho National Laboratory lands along Link 19 (Alternative 5A). The species is also known to occupy sagebrush habitat is Zone 6. Potential effects of the proposed project on pygmy rabbits include direct mortality, loss of habitat, and increased opportunity for predation by raptors. When considering the residual impacts to pygmy rabbits from this project in addition to other past, present, and future actions, impacts from the proposed project would be considered cumulatively considerable.

4.4.3.7 Trumpeter Swan

Trumpeter swans are known to use habitat in Zone 3 along the Beaverhead River and are well established in the Centennial Valley around Red Rock Lakes to the east of all MSTI alternatives through Zone 3. Construction and operation of the MSTI line would have little to no impact on trumpeter swan habitat in Montana or Idaho. The long-term residual impact would be the potential for collisions with wires, which will be minimized through implementation of an Avian Protection Plan. Implementation of an Avian Protection Plan for other proposed transmission lines nearby would further minimize potential impacts to trumpeter swans. Impacts to trumpeter swans from the proposed project are not considered to be cumulatively considerable.

4.4.3.8 Mountain Plover

Preferred habitat for mountain plovers occurs in Zones 1 and 2 in Montana. The proposed project has the potential to result in permanent loss of habitat through the construction of access roads. Other proposed activities such as subdivisions, road construction, mining, and other transmission lines also have the potential to adversely impact mountain plover habitat in the study area. When considering the residual impacts to mountain plover habitat from the proposed project in addition to other past, present, and future actions, impacts from the proposed project would be considered cumulatively considerable.

4.4.3.9 Bats

Several bat species including the Townsend’s big-eared bat are known to occupy habitat in the proposed project study area in both Montana and Idaho. Potential effects of the proposed project on bats include habitat loss and modification, increased human presence in the vicinity of important habitat features such as hibernacula, and mortality from collisions with transmission lines. Many of the 15 bat species reported in Montana also could also be affected by other types of development including wind farm development east of the Continental Divide in Montana. Table 4-7 summarizes data on bat fatalities observed at wind farms. Wildlife surveys at the Judith Gap Energy Center Project during the fall 2006 and spring 2007 migration periods (TRC 2008) estimated turbine-related fatalities of 1,206 bats (13.40 per turbine). These results suggest that estimated fatality rates for bats are higher than observed in other studies in the western U.S. Based on the range of fatalities indicated in Table 4.7 for wind farms in nonforested areas (i.e., not including Buffalo Mountain in east Tennessee) (0.07 to 13.4 per turbine per year), the 480 to 1,000 turbines in the wind farms that may be associated with the proposed line may cause estimated bat mortalities of about 37 to 13,400 per year.

Table 4-7. Bat Fatality Rates Observed at Wind Energy Projects

Wind Resource Area	State	No. of Turbines	Estimated No. of Bat Fatalities per Turbine per Year*	Estimated No. of Bat Fatalities per 100,000 m^2 of RSA per Year
Buffalo Mountain Phase 1	TN	3	20.8	NA
Buffalo Mountain Phase 2	TN	15	63.9	NA
Buffalo Ridge	MN	354	2.3	164
Buffalo Ridge Phase 1	MN	73	0.07, 0.26, 2.02	NA
Buffalo Ridge Phase 2	MN	143	1.78, 2.02	NA
Buffalo Ridge Phase 3	MN	138	2.04, 2.32	NA
Foote Creek Rim	WY	69	1.04, 1.34	97
Judith Gap	MT	90	13.4	NA
Klondike	OR	16	NA	33.3
Nine Canyon	WA	37	3.21	106.6
Stateline	OR/WA	454	0.95	53.3
Vansycle	OR	38	0.74	45
Wisconsin	WI	31	1.1	246.4

* Multiple values were included if results were from more than one study.

m^2 = square-meter

RSA = Rotor-swept area

NA = Not applicable (not calculated or appropriate)

Sources: BLM (2005b); Erickson et al. (2002, 2003a,b); Fiedler et al. (2007); Johnson et al. (2003a); Strickland et al. (2001a,b); TRC (2008); Young et al. (2003a,b).

Impacts from wind energy development precipitated by the proposed project on bat species in Montana and Idaho would likely occur outside the 2-mile-wide cumulative effects study area and would be considered an additional potential indirect effect of the proposed project. It is unclear what cumulative impacts might result from the proposed line on a more regional or population scale for individual bat species because these impacts may be reduced by employing careful siting practices and other mitigation measures.

4.4.4 Fisheries

Past and present actions have resulted in varying levels of aquatic habitat fragmentation in watersheds along the majority of the proposed project corridor. Past and present actions potentially affecting fisheries in the vicinity of the analysis area include recreational fishing, ongoing weed management, fertilization, crop production, grazing, forestry practices, road use and maintenance, and waterway modifications for stock watering for irrigation. Waterway modifications and irrigation can result in surface water flow alterations, water diversions, and stream bank modification and destabilization. Weed control and fertilization can introduce pesticides, nutrients, and total dissolved solids (salinity) into water supplies. Some grazing practices result in sedimentation to surface water due to soil destabilization from reduced vegetation. Maintenance and use of roads at river and stream crossings can destabilize banks and increase sedimentation to surface water. The MDEQ has determined that certain water bodies in the analysis area have impaired or threatened beneficial uses by one or more of the activities described above.

A portion of this analysis was conducted at the 6th Field HUC watersheds through which the proposed project or new access roads would cross. Areas affected by other future power lines and wind farms (Section 4.3) are discussed in the following sections, but because precise locations are not currently known, potential cumulative impacts are qualitatively described. The analysis includes evaluation of the proposed project's contribution to cumulative effects to fish in relation to past, present, and reasonably foreseeable actions. Only actions that could have similar impacts to fish resources as the proposed project are considered.

The proposed project's impacts to fish resources would be limited to habitat fragmentation, changes in water quality or water supply, sedimentation, and recruitment of large wood. Past and present actions that have had similar impacts to fish include timber harvest, agricultural practices, and road, transmission line, and pipeline construction. These types of projects fragment habitat either directly through construction of crossings within the stream channel or indirectly through alteration of habitat including removal of riparian vegetation and disruption of water supply. Water quality-related cumulative effects of the proposed project, including an analysis of changes in forested land, are discussed in Section 4.4.

Construction of similar reasonably foreseeable actions (Section 4.3), in addition to the proposed project, could contribute to cumulative impacts to fish. The USFS's reasonably foreseeable projects include the East Deer Lodge Valley Landscape Restoration Project and the Homestake Pass Salvage and Restoration (Section 4.3). Both of these actions would require removal of trees, which would likely require road construction. Both projects also include aquatic and riparian restoration elements. Wildfire has occurred within the project area in the past and will continue into the future. Detailed information about fire locations along the alternatives and local routing options is not readily available, and future fire locations are not feasibly predicted. Future construction activities in the region, including construction of wind farms and other power lines, could affect fish habitat by:

- Temporarily increasing soil erosion and stormwater runoff due to ground-disturbing activities, heavy equipment traffic, and extraction of geologic materials from borrow areas or quarries
- Temporarily or permanently diverting surface water flows by access road systems, stormwater control systems, or excavation activities
- Temporarily reducing stream flows due to water withdrawals for construction activities (for example, for concrete preparation and dust control)
- Increasing the short-term potential for runoff or spillage of fuel, oil, and herbicides
- Reducing recruitment of large woody debris.

The proposed transmission lines would typically span creeks and streams, but the most likely contribution to cumulative impacts on fishery resources would be from the increased fragmentation of habitat. The proposed project, other power lines, and wind farms could require construction of access roads (some permanent, some temporary).

As discussed in Chapter 3, it is these access roads that would be the main avenue of potential impact to fishery resources. Other reasonably foreseeable linear projects (e.g., transmission lines and pipelines) would presumably also require construction of access roads. If one or more of those other linear projects are constructed in close proximity to the proposed project, there is the potential for the cumulative effect of access roads resulting in unacceptable impacts to water quality, aquatic habitat, and habitat fragmentation; conversely, those projects could reasonably be expected to use portions of the same access road network, thereby minimizing new road construction and contributions to cumulative impacts.

All streams crossed by new access roads associated with the proposed project in Idaho would occur on intermittent streams (Table 3.3-5). No fish-bearing streams are crossed by new access roads associated with the proposed project in Idaho. The transmission line itself would span Beaver Creek (Alternative 4A), Camas Creek (Alternatives 5B, 5C, and 5D), and Medicine Lodge Creek (Alternative 5A). These streams are considered possibly or historically occupied habitat for Yellowstone cutthroat trout; however, the current status of the fisheries is unknown. In Idaho overall, the proposed project would affect at most about 0.3 percent of any given 6th Field HUC crossed by the transmission line (6.6 acres per mile for structures). If the most conservative approach were taken and it was assumed the entire 220-foot-wide ROW were cleared, this would only reflect a change of about 1.3 percent at most in the HUCs in Idaho. Ninety 6th Field HUCs crossed by the project in Idaho range in size from approximately 11,000 to 230,000 acres.

Fish resources within a watershed could be affected by the cumulative effects of the proposed project taken into consideration with past, present, and reasonably foreseeable projects. Reasonably foreseeable projects in Idaho include Gateway West, Overland, and SWIP transmission lines and pipeline projects such as Sunstone and Bronco (Table 4-3). New access roads would be required for all of these projects in Idaho. The locations, streams, and watersheds potentially crossed by these projects are not known at this time for Gateway West and Overland. For SWIP, the only locations at which SWIP and MSTI are in the same vicinity is at the Midpoint Substation, and there are no fish or water quality concerns at this location. It is reasonable to assume that these projects would use existing roads to the extent feasible. Implementation of environmental specifications, agency best management practices (BMP), and additional mitigation measures would require fish passage at all new culverts on fish-bearing streams and minimize habitat fragmentation from new road construction.

Increased road density within a watershed has the potential to alter the runoff patterns, reduce recruitment of large wood, increase sediment input, and otherwise degrade water quality. The potential for changes in runoff patterns is expected to be minimized by application of effective BMPs such as erosion control at relief culvert outfalls. The contribution to reductions in large wood is a function of the habitats through which roads would be constructed. One of the mitigation measures for the proposed project would require all non-saleable large wood to be left in place to maximize recruitment of large wood (Section 3.3.5). Zone 1 is the only zone within which substantial amounts of forested habitat would be crossed by the proposed access roads for all alternatives (Zone 2 has portions of some alternatives that would cross forested ground). Other reasonably foreseeable actions in Zone 1 that could also reduce the input of large wood to local streams include routine timber harvest operations on the national forest, wildfire, agricultural activities, and construction of other linear projects (transmission lines, pipelines, and roads). Details on the location of foreseeable actions are not available at this time. On a watershed basis, the percentage change attributable to the proposed project is relatively minor compared to wildfire or timber harvest that could affect thousands to hundreds of acres respectively (Section 4.4.14).

Few potential cumulative adverse impacts to water resources were identified from future operation of wind farms, and none were identified for future upgrades of electric transmission lines. Wind farm operations would have minimal impact on water quantity and quality. Future upgrades of electric transmission lines would not affect water resources because there would be requirements for water use or wastewater discharge, and stormwater controls would be required during construction.

It is expected that requirements for allowing fish passage, limiting erosion, reducing sedimentation, and limiting the periods of in-water work would serve to reduce the contribution of each reasonably foreseeable project to habitat fragmentation and related cumulative impacts to fisheries resources. With transmission lines, the line spans water bodies and access roads would avoid and minimize the number of crossings required. For this reason, the proposed project is not considered to result in any considerable changes to water quality and when taken together with past and present activities would not result in a substantial adverse cumulative effect.

4.4.5 Cultural Resources

Cultural resources in the area would be affected by projects that connect to the proposed transmission line (including wind farms), enter the proposed Townsend Substation (new transmission lines and upgrades), and other development actions that cause additional ground disturbance. Therefore, these activities have been included in the cumulative effects analysis for paleontological and cultural resources.

Numerous pre-existing ground disturbing developments occur within the physical impact study corridor (all projects listed in Section 4.3 disturb ground to some extent). The proposed project cumulative impacts are analyzed in the context of these preexisting disturbances. Past and present actions including historic settlements, farming, roads, railroads, canals, transmission lines, telephone and fiber optic lines, and urban-related development have contributed to cumulative impacts to cultural resources throughout all environmental settings in the area of the proposed project. Roads are the most widespread preexisting development, followed by utility lines. Numerous, but distributed, areas throughout the study corridor have been subjected to mining, railroads, timber sales, and residential development.

An unknown number of prehistoric cultural resources or traditional cultural properties important to area tribes have already been destroyed in the study area by past and present actions. While the construction of the proposed project could be designed to avoid impacts to prehistoric and historic properties, impacts from reasonably foreseeable non-linear projects, such as wind farms and associated power lines, may be more difficult to avoid. The construction phase of reasonably foreseeable future actions (e.g., additional transmission lines, irrigation, and energy generation facilities) could uncover or destroy cultural resources.

When compared to the collective whole of preexisting developments, the proposed project would have a far less overall disturbance. If resources are uncovered but not destroyed, the discoveries could be beneficial to professional archaeologists. Otherwise, federal and state legislation are designed to minimize the potential for impacts to the extent possible when there is federal or state involvement in a proposed project. As will most likely be stipulated in the Programmatic Agreement, all cultural resources in the selected alternative would be identified and recorded. Impacts to sites that are eligible for inclusion in the National Register of Historic Places would be mitigated. It is through these actions following the Record of Decision that the proposed project would identify and mitigate impacts to eligible sites, thereby reducing cumulative impacts to cultural resources.

4.4.6 Human Health and Safety

4.4.6.1 Electric and Magnetic Fields

Overall, the proposed project, combined with either existing or potential future transmission lines, would influence existing electric and magnetic field (EMF) levels within the ROW and at the ROW edges. The extent to which existing EMF levels would be impacted is dependent upon a number of parameters, including the presence and configuration of existing electrical facilities. Transmission line EMFs would decrease with distance away from the line. People living and working near the proposed transmission line could potentially be impacted. The proposed route alternatives generally pass through agricultural land and farm land (approximately 75 percent of the proposed line routes are located within these areas); therefore, the potential for additional impacts from EMFs in public and residential areas is limited. In addition, there are no health-based, state or federal guidelines concerning magnetic fields, and currently the state of knowledge indicates that there may be a weak but inconclusive association between EMFs and adverse health effects.

Existing transmission lines produce their own EMFs (see Table 3.5-10 for a comparison of calculated electric field levels). At locations where the proposed transmission line or other new transmission lines would be routed adjacent to or in combination with other existing transmission lines, then the fields attributable to the proposed or other new transmission lines would interact with fields from the existing transmission lines. For example, in some cases electric field levels would increase due to the presence of the proposed transmission line, while in other cases the electric field levels may decrease (Table 3.5-10).

At locations where the proposed transmission or a new transmission line would be routed by itself where no other transmission line presently exist, the proposed transmission or other new line would introduce EMFs. The strength of these fields for the proposed transmission line is shown in Tables 3.5-9 and 3.5-11 for the appropriate line configurations (Cases 1, 2, 5, and the Alternative Mitigation Structure). Field strengths for other new lines cannot be estimated accurately until the locations, designs, and loadings of these lines is known.

Many of the existing transmission lines may predate the MFSA and would therefore require no mitigation. Existing transmission facilities built after adoption of the MFSA should already be in compliance with the MFSA.

At locations where the proposed or other new transmission lines would be routed adjacent to or in combination with other existing transmission lines, the fields attributable to the proposed transmission line would interact with fields from the existing transmission lines. The cumulative effect of mitigating those field levels would be similar to the mitigation already presented for the proposed transmission line.

It is unlikely that the proposed transmission or other new transmission line would contribute to cumulative interference with geographic positioning system (GPS) signals in a way that could not be mitigated. If the proposed project or other new lines were to use power line carriers in the future, it should avoid frequencies used by regional digital GPS stations. High-quality GPS receivers should be able to be used and operated without interference.

Overall, the proposed project, combined with either existing or potential future transmission lines in the proposed transmission line ROW, would influence existing audible noise levels within the ROW and at the ROW edges. The extent to which existing noise levels would be impacted is dependent upon a number of parameters, including the presence of existing electrical facilities and other nearby noise sources. People living and working near the proposed transmission line could potentially be affected. The proposed transmission line routing links generally pass through agricultural land and farm land (approximately 75 percent of the proposed line routes are located within these areas) and therefore limits the potential for additional noise impacts in public and residential areas. The EPA has established a standard of 55 dBA in their noise guidelines (EPA 1974), which is 5 decibels (dB) higher than the Montana state standard for noise from transmission lines at the edge of the ROW in residential and subdivided areas. Transmission line noise would decrease with distance away from the line.

Similar mitigation techniques used to reduce audible noise in resource-specific residential areas could also be implemented to reduce noise levels to comply with the EPA guidelines and/or Montana state standards.

Overall, the proposed project, combined with either existing or potential future transmission lines, could influence existing radio and television noise levels at the ROW edges. The extent to which existing noise levels would be impacted is dependent upon a number of parameters, including the various broadcast signal strengths at locations of interest and associated signal-to-noise ratios. In general, it is probable that AM radio interference can be detected if using an AM radio close to a 500-kV transmission line during rainy conditions. It is unlikely that television interference would occur, with the possible exception of the weakest signals for television sets operated very close to a 500-kV transmission line during rainy conditions. No interference from corona-generated noise would be expected for digital signals broadcast at frequencies above 1 gigahertz (GHz) from satellites.

The proposed transmission line routing links generally pass through agricultural land and farm land (approximately 75 percent of the proposed line routes are located within these areas); therefore, the potential for additional noise impacts is limited in residential areas. Transmission line noise would also decrease with distance away from the line. In addition, NorthWestern and other transmission line developers must adhere to Federal Communications Commission regulations that require persons responsible for interfering with fixed reception to rectify that interference.

The transmission lines would be patrolled regularly so that damaged insulators or other transmission line equipment that could cause interference is repaired or replaced.

4.4.6.2 Induced Currents

Overall, the proposed 500-kV transmission line, combined with either existing or potential future transmission lines, could influence the potential for induced currents. The extent to which existing conditions could be impacted is dependent upon a number of parameters, as described in the Resource Impacts section. The National Electrical Safety Code has set an induced current limit of 5 milliamperes (mA) for objects under transmission lines (ANSI 2007). If this project is approved, the MDEQ would require the project to adhere to the National Electrical Safety Code as a condition of certification (ARM 17.20.1607(2) (c)). Electric field mitigation strategies, which would also reduce induced currents, are discussed in Section 3.5.2.3. Induced currents can typically be mitigated through the application of grounding connections.

4.4.7 Land Use and Recreation

Residual impacts (after mitigation) that may result from the proposed project that were considered in the cumulative impacts analysis for land use include:

- Potential for increased access and trespass
- Removal of agricultural acreage from production
- Interference with agricultural operations including irrigation, grazing, and aerial spraying
- Preclusion of further residential development or subdivision
- Reduction in the value of the recreation experience associated with the crossing of Historic Trails/Byways, Scenic Trails/Byways, Areas of Critical Environmental Concern (ACEC), Special Recreation Management Areas (SRMA), and Wilderness Management Areas (WMA)

4.4.7.1 Potential for Increased Access and Trespass

Existing roads, whether major or minor, when combined with the proposed construction of new access roads would allow for greater administrative access on public lands and an increased chance of trespass on private lands. The proposed project, when combined with future construction of additional transmission lines or other energy-generating facilities (such as wind farms) in the area, would cumulatively add to this potential. Cumulative impacts would be reduced through enforcement mechanisms such as gates and signs where appropriate.

4.4.7.2 Removal of Agricultural Acreage from Production

Past and present actions have contributed to the reduction of agricultural acreage in some capacity. Transmission lines and power generation facilities have associated roads and structures. Other actions such as mining, transportation, airports, and subdivisions have removed agricultural land from production within the project and surrounding area. The proposed project when combined with other past and present actions would continue to remove agricultural land from production; however, removal is considered minimal when compared to the acres available for agricultural production. Cumulative effects would be for the life of the structure, road, or facility.

Future transmission lines and other energy-generating facilities could consider construction on agricultural land in the area similar to the proposed project; therefore, there would be a cumulative increase in the amount of agricultural land that would be permanently taken out of production and replaced with structures associated with these facilities. Future subdivisions around agricultural areas would further reduce agricultural acreage to housing and roads. The proposed project when combined with reasonably foreseeable future actions would not have considerable cumulative impacts to agricultural acreage.

4.4.7.3 Interference with Agricultural Operations Including Irrigation, Grazing, and Aerial Spraying

Agricultural operations have been modified to be compatible with past and present actions; therefore, when combined with the proposed project, there would be no cumulative impacts. The proposed project, in conjunction with reasonably foreseeable future construction of other proposed transmission lines, could make irrigation by sprinkler or pivot methods increasingly more difficult on agricultural lands should future transmission lines occupy agricultural land near this proposed project. Structures could divide or fragment agricultural fields, making access for the purposes of feeding and water delivery to livestock more difficult by introducing obstructions, disrupting irrigation patterns and efficiency, and reducing the choice of location for windbreaks. Agricultural operations could benefit from new access roads because they could facilitate transportation of (agricultural-related) goods and services such as water and feed to cows and hay to market. Additional elevated structures in the airspace would be a cumulative impact for pilots to avoid. Aerial spraying could become less efficient and effective and more dangerous with increasing transmission lines across agricultural fields; however, the proposed project, when combined with reasonably foreseeable future actions, does not cause additional considerable cumulative impacts.

Wind farms are constructed with landowner agreement, and they would not create a conflict with current and planned agricultural uses of surrounding land, with the exception of aerial crop dusting. Wind farms could adversely affect crop dusting on land adjacent to wind farms.

Grazing and the operation of agricultural equipment could continue around and between wind turbines, though there would be additional obstacles to farm around. Guy wires for anemometers associated with wind farms would occupy only a few square feet and would be installed with landowner permission. They would have a negligible impact on the land area in agricultural use, but plowing and harvesting patterns might need to be modified in the immediate vicinity of the turbines and roads. Construction and future decommissioning of wind farms could temporarily disrupt livestock access to supplementary feeding and watering stations (BLM et al. 2006). Upon wind farm decommissioning, land converted from cropland and pasture/rangeland use could be returned to these prior uses. No permanent land use impacts would be expected when the wind farms are decommissioned (BLM et al. 2006).

Conservation Reserve Program land disturbance would be minimal over the course of the operational life of wind farms because these lands are set aside for conservation and are usually not used for agricultural purposes; the largest impacts would be ground disturbance during the construction and decommissioning phases.

An environmental assessment for a wind farm in northeastern Montana indicated that installation of wind turbines and construction of associated wind farm facilities could disturb about 2.11 acres per wind turbine and would permanently occupy about 0.5 acres per wind turbine (MTDNRC 2007). Given the 480 to 1,000 turbines assumed to be built by wind farm developers that may be contracted for capacity on the proposed transmission line, approximately 1,013 to 2,110 acres could be disturbed for wind farm construction. About 0.5 acres per turbine, or a total of 240 to 500 acres of this land, would be permanently dedicated to use for wind farms (for example, the land occupied by turbines and support facilities) and, thus, converted from its existing uses.

4.4.7.4 Preclusion of Further Residential Development or Subdivision

Past and present actions that might have precluded/preclude further development of a residential area or subdivision include transmission lines, aviation facilities, and major roads. Other types of energy-generation facilities, such as wind farms, could limit and preclude subdivision development. These actions have regulatory, noise, and visual impacts that limit residential development or subdivisions. The proposed project, when combined with past and present actions, would not have considerable cumulative impacts because the layout of the proposed transmission line considered residential development and subdivisions.

Reasonably foreseeable future construction of transmission lines, including MSTI, would preclude future residential development within or adjacent to the ROW to adhere with clearance requirements of the National Electrical Safety Code. The line may dissuade some people from purchasing land or building homes near the line due to their concerns over aesthetics. Further, construction of transmission lines on private land could also preclude private landowners from subdividing land for future residential development; therefore, the proposed project when combined with reasonably foreseeable future actions could result in cumulative impacts to residential development in some areas. Such impacts, however, could be lessened by thoughtful layout of future projects. The proposed project, when combined with reasonably foreseeable future actions, could have considerable cumulative impacts because the layout of the proposed transmission line considered residential development and subdivisions. These impacts would be lessened by determining the best location during planning for future transmission lines and wind farms though the preclusion of residential development or subdivisions.

4.4.7.5 Reduction in the Value of the Recreation Experience Associated with the Crossing of Historic Trails/Byways, Scenic Trails/Byways, ACECs, SRMAs, and WMAs

Facilities crossing or located adjacent to important recreational areas, trails, and other SRMAs can reduce the quality of the recreational experience for some users. The natural or other attributes of these areas are what make them special, and the presence of a transmission line or other intrusion impacts that experience. The proposed project, when combined with foreseeable future actions that could be placed in these areas, has the potential to further degrade the recreational experience for users. Impacts would be lessened, however, by proper alignment or other environmental protection measures.

BLM ACECs and WMAs are generally unsuitable for wind farm development and would be excluded from consideration for development per agency management plans and direction.

4.4.8 Socioeconomics

The MDEQ provided portions of this analysis of cumulative effects on socioeconomic resources. The CEQ (1997) identifies the following potential types of cumulative impacts with socioeconomic implications:

- Over-burdened social services
- Unstable labor markets
- Disruption of community mobility and access
- Change in community dynamics
- Loss of neighborhood or community character

Other types of cumulative impacts that have socioeconomic implications include:

- Increased tax revenue as a result of wind farm development that would be facilitated by construction of the proposed project
- Increased employment

Additional cumulative socioeconomic impacts may arise from interactions between other actions and the proposed project's impacts on property values, government revenues, the economic values derived from ecosystem goods and services, electricity and transmission markets, and the social opportunity costs of affected resources. Other actions relevant to the analysis of socioeconomic cumulative effects include road and subdivision construction projects, transmission and generation projects, changes in land management, fire occurrence, or other factors that change the ecosystem's ability to supply the types of goods and services affected by the proposed project (e.g., wildlife habitat, scenic amenities, or recreational opportunities).

The information currently available does not support a description of specific changes in socioeconomic variables with certainty or specificity. Instead, it indicates that, initially, the proposed project, if implemented, would alter the degree of uncertainty and risk about future socioeconomic conditions in the region, which would interact with uncertainty and risk surrounding other reasonably foreseeable future actions, leading to higher degrees of uncertainty and risk overall. Increases in uncertainty and risk can, themselves, have economic importance separate from that of the conditions that eventually materialize. Uncertainty and risk might produce changes in effects that could occur along several dimensions:

- *Expand or contract the set of possible outcomes.* Development of the proposed project, in conjunction with other reasonably foreseeable future actions, may open the door for a project or activity that otherwise would not be possible, or close the door on others.
- *Increase or decrease the likelihood of specific potential outcomes.* Development of the proposed project might make some existing potential outcomes more likely, and others less so, increasing or decreasing the related uncertainties and risks.

- *Accelerate or decelerate the timing of specific potential outcomes.* Development of the proposed project might cause some projects or activities to occur sooner and others to occur later than they would otherwise. This shift might occur as a one-time impact or a one-time shift in outcomes, or materialize as a new trajectory for projects and activities occurring over time.
- *Increase or decrease the economic importance of specific potential outcomes.* Development of the proposed project might induce or influence changes in the scarcity of specific goods and services and, hence, alter their value; their ability to generate jobs, incomes, or financial resources; their distribution among different groups; or the uncertainties and risks associated with their use.
- *Shift the uncertainty or risk borne by different groups.* Development of the proposed project might induce or influence a shift of uncertainty and risk from one group to another.

4.4.8.1 Cumulative Impacts Related to the Labor Market, Jobs, and Income

To the extent that other reasonably foreseeable future actions create demands for labor in the region at the same time as the proposed project, the cumulative impacts could decrease the availability of local workers, leading to an increased number of non-local workers employed on the proposed project and other reasonably foreseeable future projects. The cumulative impact of secondary labor and income effects (jobs and income resulting from the re-spending of income from activities related to the proposed project and other actions) are likely to be offsetting to the extent that some firms achieve economies of scale and some of the jobs created in response to expenditures from one action would serve the needs associated with other actions. This would decrease the secondary impacts from any additional projects in the area and diminish the overall cumulative impacts on the labor market, jobs, and income. Should the proposed project stimulate other electricity-generating projects in Montana, it could generate positive regional cumulative impacts on incomes and jobs in the long-term.

It is likely that the proposed project would stimulate wind development in the region that would not otherwise occur. To the extent that the proposed project stimulates wind development, that development would constitute a cumulative impact. Case studies of three wind generation projects elsewhere in the nation indicate that economic benefits may vary widely from project to project (Northwest Economic Associates 2003). For instance, the construction phase of a wind generation project may generate up to 100 jobs, while the operation and maintenance phase may provide between 6 and 31 permanent jobs and between $103,000 and nearly $1 million in additional annual personal income. Wind projects also provide additional landowner revenue in the form of lease payments. Assuming that these types of projects cause little or no increase in government or school budgets, tax payments made by project owners may have the additional benefit of reducing the local tax burden for tax payers (Northwest Economic Associates 2003).

Economic effects of wind generation built in Montana as a result of the proposed project were estimated for several levels of wind generation activity. For this cumulative impacts assessment, it is assumed that 300 to1,500 MW of wind generation capacity could eventually be built to use transmission capacity of the proposed transmission line. 300 MW would constitute 20 percent of the load that MSTI could carry north to south. Finally, because the proposed transmission line could handle 1,500 MW total north to south, 1,500 MW of wind generation built in Montana is treated as an upper bound.

Table 4-8 summarizes the economic effects of new wind generation (Goldberg et al. 2004). The results from the study are used to proportionally estimate the economic impact of 300, 600, 800, and 1,500 MW of wind power.

Table 4-8. Estimated Economic Effects of Different Levels of Wind Generation

Amount of Wind Generation (MW)	Construction Jobs (Short-Term)	Permanent Jobs over Lifetime of Wind Farms	Construction Earnings to Montana Workers ($)	Annual Earnings from Wind Farm Operation ($)	Annual County Revenue ($ Millions)	Payments to Local Land-Owners ($ Millions)
300	530	25-30	20,000,000	2,300,000	2.3 to 3.0	1.0
600	1,060	50-60	40,000,000	4,500,000	5.5 to 6.0	2.0
800	1,400	Up to 80	53,000,000	6,000,000	Up to 8.0	2.7
1,500	2,650	Up to 150	100,000,000	11,200,000	Up to 15.0	5.1

Assuming a 1- to 2-year construction period, Montanans would earn an estimated $20 to $100 million total for the construction of 300 to 1,500 MW of wind power. Over 20 years of operation of this wind energy development, Montanans would earn approximately $2.3 to $11.2 million annually from plant operations and maintenance expenditures on all projects. The wind projects would generate another $2.3 to $15.0 million per year in county revenue from property taxes along with another $1.0 to $5.1 million per year in payments to local landowners who have turbines on their land (or about $5,000 per turbine), bringing the annual operational total economic benefit from wind farms in the area to about $6 to $31 million in Montana. Total property taxes paid by wind farm owners would be about $9,000 per MW per year.

4.4.8.2 Cumulative Impacts Related to Population

The impacts on population from the proposed project are expected to be limited; therefore, the cumulative impacts of the proposed project and other reasonably foreseeable future actions related to population likely would also be limited. The wind developments would provide jobs to both in-state and out-of-state construction workers, as well as jobs related to local purchases of goods and services (such as cement suppliers and rebar suppliers). The construction phase would support about 530 to 2,650 direct jobs during a 1- to 2-year period, with the majority of those jobs likely going to out-of-state workers.

Overall, additional development of wind energy generation projects and transmission capability would add employment to the area, which could increase demand for public services (such as schools, fire, and police), add tax revenue, and increase the need for goods locally and regionally. Some local residents may be opposed to wind farms, and thus experience costs such as stress and local divisions on where to locate wind turbines.

4.4.8.3 Cumulative Impacts Related to Housing

To the extent that other reasonably foreseeable future actions create demands for housing in the region at the same time as the proposed project, housing (especially temporary housing) would likely be further constrained, especially during the peak summer travel season. The reasonably foreseeable projects included in this analysis are still in the planning stages, however, reducing the likelihood that one or more would generate additional housing demand during the same time frame as the construction phase of the proposed project.

4.4.8.4 Cumulative Impacts Related to Public Services and Infrastructure

To the extent that other reasonably foreseeable future actions create additional demands for public services and infrastructure in the region at the same time as the proposed project, these resources would likely be further constrained. The reasonably foreseeable projects included in this analysis are still in the planning stages, however, reducing the likelihood that one or more would generate additional demand on public services and infrastructure during the same time frame as the proposed project.

4.4.8.5 Cumulative Impacts Related to Public Health and Safety

The cumulative impacts of the proposed project and other reasonably foreseeable future actions related to changes in economic well-being associated with changes in public health and safety may occur should multiple transmission lines traverse the same general area, compounding people's fears of the health impacts of EMF exposure. This is most likely in central Montana, where NorthWestern's proposed Energy Collector System would be built, and along the proposed project route in Idaho, where several transmission lines have been proposed for the same general area as the proposed project. Because several of the other proposed transmission lines are planned to use HVDC technology, the actual risks and associated cumulative impacts of EMF exposure may be minimal. Unless the public and nearby residents understand the difference between HVDC and AC technology, the perceived risks and associated changes in socioeconomic well-being may be greater.

4.4.8.6 Cumulative Impacts Related to Government Revenues

Additional projects in the same region as the proposed project may produce additional tax revenue for government entities.

4.4.8.7 Cumulative Impacts Related to Ecosystem Goods and Services

Cumulative Impacts on the Value Derived from Species and Habitats

To the extent that the proposed project and other reasonably foreseeable future actions impact populations of sensitive, threatened, and endangered species, there could be a greater likelihood of economic losses for people who value the continued existence of the species.

Agricultural Production

The proposed project, in conjunction with other reasonably foreseeable projects, may compound the impacts to agricultural production in some regions. Additional easements to accommodate other transmission lines and pipelines across agricultural land could further reduce the net earnings of some operations, and may, in combination with other market effects, induce some farmers to stop farming all or part of their land for economic reasons. Such impacts most likely would occur in the Idaho portion of the study area, where several other proposed transmission lines and pipelines may traverse agricultural areas, creating additional impacts on the same farming operations, or affecting farming operations not previously impacted by the proposed project.

Cumulative Impacts on the Value Derived from Aesthetic Resources

The cumulative impacts on the value derived from the region's aesthetic resources are most likely to occur in central Montana, where NorthWestern's proposed Energy Collector System would tie new generating facilities to the Townsend Substation. Such concentrated disturbance may permanently alter its scenic vistas and diminish the economic values associated with them. The proposed project's potential cumulative impacts on aesthetic resources may, in turn, produce cumulative impacts on property values by attracting additional industrial or commercial development to the area that would be disturbed by proposed project. The individual impacts of each new development activity could produce effects on property value greater than the sum of the individual impacts, should they exceed a threshold in which the perceived character of the area moves from primarily residential and rural to primarily industrial.

Cumulative Impacts on the Value Derived from Recreation and Tourism

Additional transmission lines and road-building activities that create new access points to recreation areas could further increase hunting pressure, disturbances to wildlife, or illicit off-road vehicle use, diminishing the quality of existing recreational opportunities and the economic well-being that individuals derive from them. The individual impacts of each new development activity could produce effects on recreation and tourism greater than the sum of the individual impacts, should they exceed a level of change so dramatic that people seeking isolation choose to recreate in other areas. Depending on the extent to which this occurs, it could reduce the number of recreation and tourism-related jobs in the region and the level of income that businesses (such as hunting outfitters) and individuals generate from these activities. Additional transmission lines and road-building activities in the region may also have potential offsetting effects, to the extent that they create or improve access to other areas in the region, drawing some of the hunting and wildlife-watching pressure away from the geographic area of the proposed project.

Quality of Life

To the extent that the cumulative impacts diminish the ecosystem's ability to provide the goods and services residents enjoy, it could diminish their quality of life. To the extent that the proposed project and other reasonably foreseeable future projects adversely affect the social capital of the region, by increasing animosity between residents and within communities, it also could also adversely affect residents' quality of life. Future projects that produce jobs and incomes could improve residents' quality of life, to the extent that they provide jobs to replace temporary construction jobs produced by the proposed project.

4.4.8.8 Cumulative Impacts Related to Electricity and Transmission Markets

The proposed project, which aims to facilitate exporting electricity generated in Montana to areas outside the state, could interact with other projects and actions, as well as with market forces to affect electricity markets and prices in Montana and elsewhere. These interactions also would affect the regional transmission market. The size and timing of the effects remain unknown.

When the proposed project begins operation, certain entities with generating capacity will seek to sell electricity outside the state. The set of potential exporters includes entities that own existing generation capacity in Montana or seek to build new capacity. Exporters can expect to obtain up to $14.63 per MWh more by selling electricity outside the state due to an estimate of the tariff on the MSTI line (Energy Strategies LLC 2009, Appendix A.1). Economic theory suggests that, if this electricity is surplus within Montana (i.e., there is no demand for it and it cannot be sold in the state), then selling it outside should have little or no impact on in-state electricity prices. If it is not surplus, though, in-state customers would have to compete with out-of-state customers, and in-state prices would rise until the market reaches equilibrium, where the exporter would be indifferent between selling electricity inside or outside the state. An assessment of the electricity market in Montana concludes, "The construction of a major exporting transmission line from Montana could open up the Montana market to additional outside forces. NorthWestern has a variety of strategies at their disposal to manage the exposure of Montana customers to substantial price risk…" (Appendix A.1, p. 40). If the proposed project, together with other projects and actions, causes in-state electricity rates to rise, it is possible that generation development spurred by the proposed project could put downward pressure on rates, offsetting some or all of the potential rate increase (Appendix A.1).

The proposed project's interactions with other projects and actions would have cumulative impacts on markets outside Montana. Potential markets for electricity exported by the proposed project include the Northwest (Washington, Oregon, and northern California), and the Southwest (southern California, southern Nevada, and Arizona) (Energy Strategies, LLC 2009, Appendix A.1). Exports to these areas via the proposed project would affect the competitive dynamics of these markets by replacing entities that otherwise would export electricity into the markets. Electricity exported through the proposed project could also compete with entities within each market that develop generating capabilities closer to demand centers or to compete with technologies and behavioral changes that would reduce demand.

Additional effects could occur as the export of electricity to these markets from Montana via the proposed project could increase demand for transmission capacity extending to the West or Southwest from the proposed project's southern terminus at Midpoint, Idaho. Transmission capacity is currently scarce in these directions. Several proposals, such as Gateway West and Gateway South, Hemingway-Boardman, Chinook, and the SWIP, seek to increase capacity. If these or other projects fail to resolve the transmission scarcity to the West and Southwest from Midpoint, the introduction of new demand associated with the completion of the proposed project could increase the market price of transmission beyond Midpoint. An increase in price would reduce the net earnings of producers of electricity coming to Midpoint from other sources and may render them unable to compete with customers in the Northwest or Southwest markets. If future transmission capacity beyond Midpoint is not scarce, electricity carried to Midpoint by the proposed project would increase the overall supply of electricity available to be exported to the two markets. The increase in supply could exert downward pressure on prices for all suppliers and transmission of electricity to the markets. These effects as a result of MSTI may be small on a grid-wide scale.

Several recent actions and changes in circumstances indicate uncertainty associated with future electricity markets that could influence the proposed project's cumulative impacts; these are described below.

- The recent recession and anticipated long recovery have changed market conditions in many ways. Economic and residential growth has collapsed in many communities, especially in the Southwest; financial markets continue to struggle; and federal spending has emphasized investments in renewable energy resources.
- On September 15, 2009, Governor Schwarzenegger issued Executive Order S-21-09 directing the California Air Resources Board to adopt regulations increasing California's Renewable Portfolio Standard from 20 percent to 33 percent the amount of electricity electric corporations that serve general customers must obtain from renewable energy resources by 2020 (CPUC 2009b).
- An assessment of the future demand for transmission capacity to carry electricity from renewable energy resources concluded that there are extensive resources within California, but that some out-of-state resources could be competitive, and the most economically competitive sources from outside California likely will materialize in Nevada, Oregon, Baja California Norte, and British Columbia (RETI 2009). This assessment also recognized that, if the cost of thin-film solar photovoltaic technologies drops as predicted by manufacturers, the state may be able to meet its renewable-energy targets by relying on widely dispersed solar photovoltaic systems rather than on large, out-of-state, centralized generation systems. A separate assessment observed that California may exhibit a strong preference for such dispersed systems because they would encourage innovation and their development would yield far more jobs and higher incomes for local workers than systems that rely on out-of-state generators (CPUC 2009a). Future demand for out-of-state electricity also could be diminished through accelerated investment aimed at reducing the overall demand for electricity.
- The Northwest Power and Conservation Council, which develops and oversees the implementation of a regional power plan, recently issued a draft plan that identifies accelerated efforts and investments to improve the efficiency of electricity use as the most cost-effective and least risky approach for balancing supply and demand. Accordingly, it envisions that the region will rely on enhanced energy efficiency to meet 85 percent of new demand for electricity over the next 20 years (Northwest Power Planning and Conservation Council 2009).
- Anticipated changes in climate are expected to alter both the demand for and the supply of electricity (California Energy Commission 2009).

4.4.8.9 Cumulative Impacts Related to Social Opportunity Costs

The use of limited public and private resources toward other projects in addition to the proposed project would eliminate opportunities for other beneficial uses of these resources. The cost imposed on society by these situations is equivalent to the greatest benefit that could be derived from these resources otherwise, known as opportunity costs. Changes in demographics, tastes, preferences, and other influences on demands can cause the most valuable foregone use of limited resources used by the proposed project to change over time. The potential for future shifts in demand to increase opportunity costs is related to the scarcity of adequate substitutes for said demand, such as scenic vistas and undisturbed recreation areas within short travel times for local residents. General experience with development affecting public goods raises particular concern about the likelihood that multiple actions and projects could increase the value of alternative uses of resources, and thus, the social opportunity cost, of resources dedicated to potential future projects.

4.4.9 Soils

Past, present, and reasonably foreseeable future activities (Section 4.3) all contribute to cumulative soil impacts in the area of the proposed corridor as well as on a more regional scale. These activities may include:

- Road construction
- Mineral resource extraction or development
- Logging
- Agriculture
- Subdivision development
- Additional linear transmission facilities
- Wind farms
- Other development unforeseen at this time

The cumulative effect of the proposed project and other activities on soil resources is dependent on the residual soil impacts. Unlike the potential effects of a linear corridor on resources that are transient (i.e., wildlife and surface water), residual impacts to soils from other activities and the proposed project are primarily direct and limited to the footprint of the activity itself (Section 3.8.). Within the footprint, soils would be impacted by construction or other soil-disturbing activities, road building, and development of soil borrow areas. These activities could also have an impact on other resources. Soil erosion could result in increased sediment transport to surface waters in areas adjacent to the corridor. Impacts to existing vegetation, including noxious weed invasion, and revegetation potential would also increase as the result of soil disturbance and erosion. Impacts associated with road development are influenced by the degree and frequency of maintenance and use.

Mitigation measures (Section 3.8.4) including restrictions on equipment travel during construction, minimal construction of new roads, use of overland travel routes, implementation of erosion control, site reclamation BMPs, and monitoring and maintenance would minimize residual soil impacts of most activities. Some of these impacts, namely erosion, should decrease over time following most construction activities as mitigation/reclamation measures lead to establishment of permanent vegetation and an attendant decrease in erosion.

It is possible that construction of the proposed project and associated roads and infrastructure may facilitate additional development and thus contribute to cumulative soil impacts. The cumulative impacts to soil resources from the proposed project would not be cumulatively considerable and is therefore considered a less-than-significant cumulative impact.

4.4.10 Geology

Past, present, and future activities and development that contribute to geological cumulative effects would be similar to those that impact soils (Section 4.4.9). Residual geologic impacts from the proposed project are located primarily within and adjacent to the corridor. Construction activities within or adjacent to the proposed project corridor or regionally would contribute cumulatively to ground-disturbing activities, which can impact topography and bedrock. Additionally, excavation of borrow materials could impact geological resources, although impacts would be mostly restricted to unconsolidated or poorly consolidated materials.

It is also possible that geohazards, including earthquakes and mass movement, could impact the proposed transmission line and result in the disruption of power transmission and travel. Impacts to structures and infrastructure could lead to damage to power lines, roads, and possibly result in injury or death. Engineering design and construction mitigation measures (Section 3.8.4) would minimize impacts to the geologic resource.

The degree to which the proposed project would contribute to cumulative impacts would be dependent on the type and extent of specific future activity. On a watershed basis, the proposed project's contribution to cumulative impacts on geologic resources would be expected to be similar to or lower than those associated with major resource development. On a regional scale, the residual geologic impacts from the proposed project would not be expected to be cumulatively considerable within the context of the applicable projects listed in Section 4.3. Geohazards resulting in damage to structures or infrastructure could have a substantial cumulative impact.

4.4.11 Paleontology

Past and present actions including urban and industrial development, agriculture, resource extraction, logging, transportation, and power transmission have contributed to cumulative impacts to paleontological resources throughout the region of the proposed corridor. Similar activities in the future could also contribute to cumulative effects on paleontology. Paleontological resources in the area would be affected by projects that connect to the proposed transmission line (including wind farms), enter the proposed Townsend Substation (new transmission lines and upgrades), and other development actions that cause additional ground disturbance. These activities have therefore been included in the cumulative effects analysis for paleontological resources.

Impacts to paleontological resources are related to the extent and type of paleontological resources present and the amount of ground disturbance, both of which vary on a project-specific basis. The level of impacts would be proportional to the scale of the project. If clearing, grading, excavation, and road construction are very limited, the impacts would also be limited. If more extensive excavation or road construction is needed during construction, more extensive impacts are possible. Impacts during operation would normally be less than those during construction. The following describes the potential cumulative impacts to paleontological resources if they are present at a project site (e.g., a wind farm). Clearing, excavation, boring, blasting, and other activities associated with construction of towers and ancillary infrastructure could impact paleontological resources associated with the proposed project. Unauthorized collection of fossils during site monitoring, construction, and operation could also impact paleontological resources. Increased activity and access in adjacent lands related to construction of the proposed project could lead to increased erosion or illegal collection of paleontological resources. Although many of the activities (e.g., during the monitoring and testing phases) are characterized as temporary actions, paleontological resources are nonrenewable, and once removed or damaged cannot be recovered or recreated in the appropriate context for scientific analysis.

Mitigation measures (Section 3.9.5 and listed by BLM 2005), including a pre-construction paleontological survey, monitoring of sensitive geologic units during construction, and limiting access to areas adjacent to the corridor through road closures, if implemented could reduce direct impacts and the proposed projects contribution to cumulative impacts. Given the relatively small proportion of ground disturbance associated with the proposed project relative to past, present and reasonably foreseeable ground-disturbing activities (Section 4.3), the residual paleontological impacts from the proposed project would not be expected to be cumulatively considerable within the context of the applicable projects listed in Section 4.3. However, significant paleontological resources are not uniformly distributed, and areas within the project corridor have the potential to yield scientifically significant and important paleontological resources (Section 3.9), most notably vertebrate fossils. Even though mitigation measures are expected to minimize the residual impacts, the potential exists for the loss of paleontological resources. Depending on the significance and importance of the resource, the proposed project may contribute to cumulative impacts to paleontological resources.

4.4.12 Vegetation

Wildfire, wildfire suppression, insect outbreaks (e.g., mountain pine beetle), grazing, range improvement projects (i.e., structural, such as fencing and water developments; and non-structural, such as seeding, chaining, harrowing, and fuel treatments), various types of land conversion including agriculture, logging, mining, housing developments, roads, and other similar activities have all historically impacted and currently impact vegetation resources. A dramatic example of this is the recent and ongoing mountain pine beetle outbreaks in Montana. The current outbreak began in the late 1990s and by the end of 2008 had affected more than 3.35 million acres in Montana, with over 31 million trees having been affected (MTDNRC 2009). Qualitative observations of the project area in 2009 suggest that the number of affected acres has risen dramatically since the last reporting period in 2008. To date, forests in Zone 1 have been hit hardest, but forests in Zones 2 and 3 have also been impacted and will likely also be severely impacted by these beetles before the outbreak subsides. To put the scale of this outbreak in context, the last mountain pine beetle epidemic in Montana was in the 1970s and 1980s, and at the peak of the outbreak in 1982, had affected 2.2 million acres (MTDNRC 2009). This previous epidemic lasted through 1990.

Some activities, such as livestock grazing, have changed over time as better management techniques are implemented. With these changes, rangeland health conditions for grazing have actually improved in most areas over time as the land has recovered. Perhaps the biggest cumulative impact to vegetation resources—and the primary risk posed by the proposed project and other types of developments considered in this cumulative impact analysis to vegetation communities, rangeland health, and special status plant species—is that of noxious weed and other invasive plant species (e.g., cheatgrass) invasion. In fact, for the majority of special status plant species that potentially occur in the project area and outside the project area, noxious weeds are considered to be one of the major threats to their continued persistence. Where special status plant populations can be spanned or direct impacts avoided by the transmission line or other developments, noxious weeds are much more insidious and harmful to native plants and the creatures that depend on them. In addition to robbing native vegetation of space, light, moisture, and nutrients, noxious weeds, and in particular, cheatgrass, can permanently alter fire regimes. Changes to the frequency and intensity of fire regimes can cause significant changes in the plants inhabiting a location, and consequently site hydrology and the wildlife that use it.

Disturbed lands are the most susceptible to noxious weed and cheatgrass infestation. Unless strict prevention, control, and eradication measures are implemented and firmly enforced, any future land-disturbing projects will continue to facilitate the spread and establishment of noxious and invasive weeds, further degrading the value of vegetation resources to wildlife and humans, degrading rangeland health, and threatening special status plant species. The proposed project would result in disturbance ranging from 6,000 to 8,000 acres of land through construction of the 500-kV transmission line, access roads, staging areas, transmission facilities, and other project features. Wind farm construction in Montana could add roughly another 1,000 to 2,200 acres of disturbance. This removal of vegetation and exposure of soil, coupled with construction equipment moving from area to area and site to site, creates ideal conditions for noxious and invasive weeds to invade new areas. Other land-disturbing activities and especially other transmission line projects proposed in the area, such as the Chinook 500-kV HVDC transmission line, NorthWestern Energy Collector System, Overland Line, and SWIP can be expected to have similar types and levels of impact to the land and pose similar risks to the continued expansion of noxious weed and cheatgrass infestations in Montana and Idaho.

The proposed project has numerous measures (such as prevention, control, eradication, and monitoring) that would help to minimize its contribution to the adverse cumulative impact noxious weeds would have on natural resources in the project area. The degree of resolve, commitment, persistence, and financial backing in treating noxious weeds in the project area by both NorthWestern and adjacent landowners will ultimately determine how much the proposed project would contribute to the spread and establishment of noxious weeds. However, based on the current extent of noxious weeds and their life history traits, there is little doubt that with the project's projected level of impact that it would contribute to the cumulative impacts caused by noxious weeds and other invasive plants in the project area. It is important to note that noxious weeds, albeit more slowly, are likely to continue to spread and become established in the project area with or without construction of the transmission line and associated infrastructure. The main impact that this and other projects considered in this cumulative impact analysis are likely to have on this pandemic noxious weed problem is the rate at which the noxious weeds are spread across the landscape and the rate and level of effort at which control efforts must be implemented to cope with the problem.

4.4.13 Visual Resources

For the proposed project area, the physical scope of this cumulative impacts analysis is composed of the portions of the viewsheds of the transmission lines in the centers of the ROW of the alternatives being considered that could potentially be most affected by the project plus viewsheds of other proposed facilities. A distance of 3 miles on either side of the ROW and around the other facilities was determined to be the most appropriate distance for assessing cumulative effects related to transmission lines. This distance was selected based upon observations in the project area of the relative visibility of existing transmission lines at various distances (see Appendix C.11.1, Section 3.11.1, Existing Conditions Supplement), professional experience with transmission line visual impact assessment, and from consulting the post-construction visual monitoring study of the (then) newly built Colstrip line that was conducted in 1987. The study was conducted by a team of landscape architects from the Bonneville Power Administration, Lolo National Forest, BDNF, and the Montana Department of Natural Resources and Conservation (Embree et al. 1987). The study helped confirm that the portion of the viewshed within 3 miles of either side of the ROW is a reasonable distance for assessing cumulative effects. For cumulative effects of potential wind farm development, a broader regional area is considered.

Consideration is given to the landscape changes that have taken place in this analysis area in the past, are taking place in the present, and have a reasonably foreseeable potential to take place in the future. Proposed projects are classified as reasonably foreseeable if they are publicly known and if permits have been applied for from local, state, or federal authorities. Some projects such as wind developments might ultimately be associated with the proposed project if they transmit their electricity over proposed transmission lines. However, at this point, no such associations are known to exist and therefore, no analysis of impacts can be credibly performed. For the assessment of the cumulative visual impacts of the proposed high-voltage transmission line, the projects that are most relevant are large-scale linear projects such as railroads, major highways, and other transmission lines, and other large-scale, landscape-transforming projects that are non-linear in nature, such as mining operations, large processing plants, large power plants, wind generation facilities, and timber harvest.

The current visual conditions in the landscapes that the various links being considered for the proposed project would pass through are described in Section 3.11.1. The visual conditions that now exist in these landscapes are in many cases substantially different from those that existed before the influx of Euro-Americans to the region in the late 19th century. Since that time, the construction of railroads, highways, mines, dams, reservoirs, irrigation systems, towns, and dispersed residences, as well as conversion of land to grazing and use for field and row crops has transformed what was not too long ago an entirely natural-appearing landscape to one in which in views from the valleys and the areas in the foreground and middleground are often dominated by areas of substantial human modification. The specific contribution of the development of electric transmission lines to these visual changes are documented in Section 3.11.1.2 and in Appendix C.11.1. As the analysis of the proposed project's visual effects in Section 3.11.3 suggests, in places where the project will be visible in the near to middleground, and will not be visually absorbed into the landscape setting, it will tend to increase the perceived level of human modification of the landscape, reinforcing the overall pattern of an incrementally intensifying overlay of human modification of the valley areas and surrounding hillsides.

In terms of reasonably foreseeable future visual change in the viewsheds extending out 3 miles from the proposed segments, the most likely changes are those that could be associated with the potential future development of the Chinook transmission line project now being planned by TransCanada. The Chinook line is a proposed 1,000-mile 500-kV direct current transmission line that may run from near Harlowton, Montana, to a southern terminus near Las Vegas, Nevada. The final routing is not known at this point. However, if the Jefferson Valley Route were to be selected for the proposed project, and if the final route for the Jefferson Valley portion of Chinook line were to be located within the impact area of this MSTI route, the combined effect of the two projects would be to create a major, and in certain locations, visually dominant transmission corridor in an area where currently no major transmission facilities exist. In the I-15 corridor from Dillon south to the Idaho state line, given the limited width of the valley through the mountains, it is inevitable that the proposed transmission line and the Chinook transmission line would be in close proximity. This would create a sense for some travelers on I-15, as well as for residents and recreation users in the surrounding area, that the valley and high mountain pass through which the interstate travels (and the corridor that the transmission lines would follow) would be more developed in appearance than they currently are. Some locations along the I-15 corridor would be visually dominated by parallel sets of large transmission structures. In Idaho, if the eastern alternative is selected for the proposed project, it is possible that the proposed line and the Chinook line would be in close proximity, creating the sense of a major transmission corridor with a strong visual presence in the area along I-15 from the state line to just north of the Borah Substation.

The Overland transmission project is another reasonably foreseeable project that could play a role in combining with the proposed project to create cumulative impacts. Overland is a 500-kV transmission line proposed to extend from Wyoming to the Midpoint Substation in Idaho. To the extent that the final route selected for the portion of this proposed line between the Borah Substation and the Midpoint Substation is located within 3 miles of the routes proposed for Alternative 6A, in those areas, the two lines combined would intensify the visual dominance of the existing transmission corridors that Alternative 6A follows.

In the vicinity of the Midpoint Substation, the proposed transmission line would contribute to an overall increase in the density of large transmission structures, adding to the new structures that would be introduced to this area by development of the Overland transmission project and by the SWIP, a 500-kV transmission facility that will begin at the Midpoint Substation and travel south toward Las Vegas.

Changes to forested areas along the proposed line (and other potential projects discussed above) could change the appearance of the landscape and eliminate or reduce the screening value of trees in hiding or screening changes to the landscape from viewers. These changes to forested areas could be associated with insect infestations/disease, wildfires, and/or timber harvest.

If decommissioning occurred, impacts on visual resources would be similar to those encountered during construction. Restoring a decommissioned site to pre-project conditions would entail recontouring, grading, scarifying, seeding, planting, and, perhaps, stabilizing disturbed surfaces. Newly disturbed soils would create a visual contrast that would persist at least several seasons before revegetation would begin to disguise past activity. Restoration to pre-project conditions may take much longer. Invasive species may colonize newly and recently reclaimed areas. Non-native plants would likely produce contrasts of color, form, texture, and line.

4.4.14 Watersheds and Wetlands

The spatial scale used for the general cumulative impact analysis is the proposed project area; that is, 2 miles on either side of the proposed alternative and local routing option centerlines, for a 4-mile-wide corridor. For cumulative effects to riparian/wetland areas, the fifteen 4th Field HUCs crossed by the proposed project were used as the spatial extent. For the cumulative watershed effects analysis discussed below, the analysis was conducted in all forested 6th Field HUCs through which the proposed project (alternatives and new travel network, including ROW) would pass or "fields."

Wildfires and grazing, as well as various types of land conversion including agriculture, logging, rangeland improvement projects, mining, housing developments, roads, and other similar activities have all historically impacted, and/or currently impact wetland resources in the project area. Some activities, such as livestock grazing, logging, and mining have changed over time as more resource-conscious management or extraction techniques are implemented. For example, the practice of clearing willows with herbicides or other means to increase forage production is no longer occurring at a large scale, and in fact is being reversed in some areas where river and floodplain restoration activities such as riparian fencing and active willow planting are occurring (e.g., upper portion of the Big Hole River watershed). With these changes, conditions in water and wetland resources are commonly considered to have improved in many areas over time. Cumulative impacts caused by noxious weeds are also a concern in riparian/wetland areas and are discussed in Section 3.10.8.

Impacts to riparian/wetland areas are expected to be avoided by spanning these areas wherever possible. In addition, the placement of fill material (i.e., impacts) into surface waters and wetlands is regulated by the U.S. Army Corps of Engineers, the EPA, MDEQ, and in certain cases in Montana, by conservation districts. Most wind farms are expected to be located in upland areas where winds and soils for foundations are more favorable. Access roads are necessary to reach turbines, and a few of these may have to cross wetlands or riparian areas. For wetlands, these impacts are typically mitigated on site or at offsite locations in the same watershed by minimizing disturbance, creating new wetlands, restoring or enhancing wetlands, and/or preserving existing high quality wetlands. Because of these avoidance measures and compensatory mitigation requirements, the proposed project is not expected to contribute to the cumulative loss of wetlands. Similarly, other proposed projects in the area are also not expected to cause a cumulative loss to wetland resources; however, non-wetland riparian areas are not regulated by these agencies and some impact to riparian areas may occur.

Though this impact is expected to be minimal, the proposed project and other types of proposed future projects, including transmission line projects such as the Chinook transmission line, NorthWestern Energy Collector System, Intertie Line to Garrison, Overland Line, and SWIP, in the area may contribute to the cumulative loss of non-wetland riparian areas. The extent to which this would or could occur is currently unknown.

The proposed project would require construction of a network of access roads (some permanent and some temporary). Other transmission projects may have similar access requirements, and access roads are typically needed for construction of wind farms. As discussed in Chapter 3, it is these access roads that would be the main avenue of potential impact to surface water resources. Other reasonably foreseeable linear projects would presumably also require construction of access roads. If one or more of those other linear projects (e.g., Chinook) is constructed in close proximity to the proposed project, the potential exists for the cumulative effect of access roads, resulting in impacts to water quality and aquatic habitat; conversely, those projects could reasonably be expected to use a portion of the same access road network, thereby somewhat reducing new road construction and appurtenant impacts.

Increased road density within a watershed has the potential to alter the runoff patterns, reduce recruitment of large wood, increase sediment input, and otherwise degrade water quality. The potential for changes in runoff patterns is expected to be minimized by application of effective BMPs such as erosion control at relief culvert outfalls. It is expected that similar requirements for limiting erosion, reducing sedimentation, and limiting the periods of in-water work would serve to reduce the contribution of each reasonably foreseeable project. With transmission lines, the line spans water bodies, and access roads would avoid and minimize the number of crossings required. For this reason, the proposed project is not considered to result in any considerable changes to water quality, and when taken together with past and present activities, would not have a considerable contribution to cumulative impacts across the project area. Some residual impacts would remain, however, even after the application of BMPs and other mitigation measures, and in watersheds that have already been heavily impacted, the residual impacts from the proposed project could result in cumulatively considerable impacts to water quality.

Of particular concern from a water quality perspective are the cumulative impacts from vegetation clearing on forested lands. The proposed transmission line would traverse lands managed by the BDNF in Montana and the CTNF in Idaho. Some of these lands have a history of use for timber production. The road network and ROW corridor associated with the proposed project and possibly other transmission lines would require the removal of additional trees on these lands and thus represents additional timber management activities on these lands that could cumulatively have a negative impact on water resources.

To evaluate this possibility, the USFS provided historic timber harvest data in a GIS format, and these data were evaluated for each 6th Field HUC through which the proposed transmission line project or its proposed new travel network would pass. As an initial screening level assessment, all harvest activities of any kind and from any year were treated as recent clear cuts to evaluate a worst case scenario for existing condition in the target HUCs. These data were used to calculate the percentage of each HUC that had been the subject of disturbance prior to the proposed project. Next, the total area in each HUC that would be cleared for the 220-foot power line ROW and its 24-foot-wide access roads was calculated and used to determine the additional percentage of each HUC that would be disturbed if the proposed transmission line were constructed. In HUCs where multiple alternatives are proposed, this analysis was based on the alternative that would have the largest impact because only one alternative would be constructed if the proposed project is approved. This approach was selected as the worst-case scenario. For those HUCs where this initial screening step revealed a level of disturbance greater than 10 percent of the total HUC area, a more detailed assessment was conducted in which timber management activities before 1980 were eliminated from consideration because these areas have had 30 years to recover.[2] The presumption was that, within the northern Rockies, clearcuts and burned areas recover hydrologically in approximately 30 years on average, with some wetter types recovering faster and some dryer vegetation types recovering more slowly (Callahan 1996). All harvest activities regardless of type were treated as clearcuts to maintain a conservative approach to the analysis.

[2] Data limitations prevented consideration of harvest year for Idaho HUCs.

The 10 percent disturbance threshold was selected as an approximation of the level of impact at which cumulative watershed effects might be expected. This value of 10 percent of watershed area cleared is a commonly accepted threshold above which cumulative watershed effects could begin to occur. In reality, however, there is no such single-number threshold. Other factors such as channel stability and vigor of riparian vegetation would be factored in if one was trying to refine the threshold value for each watershed. That level of detail was not available for this large-scale EIS; therefore, a 10 percent threshold was used as a reasonable value. The 10 percent threshold is a conservative estimate of when cumulative watershed effects could be expected. For comparison purposes, the Targhee Revised Forest Plan advises that not more than 30 percent of any of the principal watersheds and their subwatersheds should be in a hydrologically disturbed condition at any one time.

Another aspect to this analysis that added a conservative margin for error is that the assumption was made that all trees and tall shrubs would be removed within the entire ROW width for the entire length of each alternative on USFS ground. Depending on topography and existing vegetation, the proposed action may require little or no vegetation removal. This would not be determined with certainty until final design; therefore, this cumulative watershed effects analysis made the assumption that the areas would be fully cleared.

On CTNF, 40 6th field HUCs were included in the analysis. The 10 percent impact threshold was exceeded only in the Miners Creek-Beaver Creek HUC. Approximately 9.5 percent of the watershed has been impacted by previous timber management activities. Alternative 4A and its associated new travel network would result in clearing of another 0.8 percent of the watershed (256 acres), bringing the total disturbance in the watershed to 10.3 percent, just exceeding the 10 percent threshold (Table 4-9). The screening level data analysis that was conducted for this cumulative effects assessment was not of sufficient resolution to determine the type of harvest activities that had occurred in the Miner Creek-Beaver Creek HUC or the year in which harvest activities occurred. Instead, the analysis treated all harvest activities of any kind as clearcuts and assumed that the cuts were recent enough that no recovery has occurred. In reality, this is unlikely to be the case. If even a small portion of the prior harvest activity was conducted at less than clearcut intensities, or if the cuts occurred long enough in the past that the vegetation has recovered to some extent, then the 10 percent threshold would not be exceeded in the HUC. It thus appears that cumulative watershed effects are probably not a concern in the HUC. Mitigation measures described in Chapter 3 are intended to minimize the impacts associated with road construction and clearing of the transmission line ROW.

On the BDNF, 84 6th Field HUCs were included in the analysis. The 10 percent threshold was exceeded in five of them based on the screening level analysis in which all timber management activities were treated as recent clearcuts. These HUCs include North Fork Divide Creek, Homestake Creek, Headwaters Boulder River, Boulder River-Rock Creek, and Cataract Creek (Table 4-9). However, based on the secondary level of analysis, which limited pre-MSTI impacts to timber management activities that have occurred since 1980 and from which vegetation and streams have had 30 years to recover, none of the HUCs exceeded the 10 percent threshold (Table 4-9). Homestake Creek HUC was the closest, with a post-1980 disturbance level of 9.2 percent of the HUC. The proposed project would disturb another 0.4 percent of the HUC, for a total post-MSTI disturbance of 9.6 percent of the total HUC area. Even in this case, though, all post-1980 timber management activities were treated as clearcuts. In reality, a portion of these would most likely have occurred at less intensive harvest levels, and thus 9.6 percent represents a worst-case scenario.

The current SOPA for the BDNF indicates that Homestake Pass Salvage and Restoration Project could occur in the Homestake Creek HUC in 2011. The project would include salvage logging of 257 acres of dead and dying lodge pole pine and 593 acres of slashing and burning of conifers encroaching on aspen stands, for a total disturbance of 850 acres. Treating these acres as clearcut, as was done for the screening level assessment, the Homestake Pass Project would result in an additional 6 percent of the HUC in disturbed condition, which would bring the total post-MSTI disturbance to approximately 16 percent of the HUC. This level of disturbance suggests that the HUC may be at risk from cumulative impacts. Thus, all management activities, either from the proposed project or the Homestake Pass project, should be conducted with caution and all possible steps should be taken to mitigate possible impacts. No other proposed actions were identified for the five HUCs in Table 4-9.

Overall, the proposed project would disturb no more than 0.8 percent of any forested HUC in the project area (Table 4-9). With the possible exception of the Homestake Creek HUC as discussed above, total disturbance levels would remain below 10 percent in all HUCs, well below this threshold in all but a few cases.

Available GIS data for lands outside the national forests were insufficient for conducting a similar analysis on non-forest watersheds. In most cases, however, these non-forest watersheds have been previously impacted, and thus the residual impacts from the proposed project could potentially combine with the residual impacts from previous disturbances to cumulatively affect water quality in these watersheds. Of particular concern are watersheds containing streams that appear on the Montana and Idaho lists of impaired water bodies, or in which total maximum daily loads have already been completed. These are watersheds in which past disturbances have already threatened or impaired beneficial uses, and which, as a result, may have difficulty assimilating the residual impacts to water quality that could result from the proposed project. Total maximum daily loads and listed water bodies are discussed in Section 3.12. To avoid cumulative impacts to these and other watersheds, stream crossings associated with the new travel network would be constructed in consultation with the relevant regulatory agencies, and crossing locations would be selected during a site inspection with agency personnel. All project-related construction would be subject to the BMPs and mitigation measures proposed in Chapter 3.

Table 4-9. Cumulative Watershed Effects Analysis Results

				Percent of HUC Impacted				
HUC Name	**HUC Number**	**National Forest**	**HUC Size (acres)**	**Pre-MSTI (all years)**	**Disturbed by MSTI**	**Total Post-MSTI (all years)**	**Pre-MSTI (since 1980)**	**Total Post-MSTI (since 1980)**
Miners Creek-Beaver Creek	170402140207	CTNF	32,018	9.5	0.8	10.3	NA	NA
North Fork Divide Creek	1002000041001	BDNF	19,313	11.9	0.3	12.2	1.4	1.7
Homestake Creek	100200050202	BDNF	13,306	17.6	0.4	18	9.2	9.6
Headwaters Boulder River	100200060102	BDNF	12,076	33.5	0.2	33.7	6.6	6.8
Boulder River-Rock Creek	100200060104	BDNF	23,657	9.4	0.6	10	1.8	2.4
Cataract Creek	100200060302	BDNF	21,489	11.7	0.3	12	8.2	8.5

4.4.15 Environmental Justice

Other actions relevant to the analysis of environmental justice cumulative effects include road and subdivision construction projects, transmission and generation projects, and changes in land management or other factors that change the ecosystem's ability to supply the types of goods and services affected by the proposed project (e.g., wildlife habitat, scenic amenities, or recreational opportunities). To the extent that other projects affect the same populations of low-income or minority groups, the magnitude of the impacts may be greater—perhaps much greater—than the impacts of the proposed project alone.

Projects or actions that impose direct monetary costs on low-income populations (e.g., through higher or lower electricity rates) could combine with similar effects of the proposed project, should they materialize. The cumulative impact of higher electricity rates on a low-income household, for example, would be a reduction in income available to pay for food, housing, or other necessities. This effect could result in adverse impacts to health and well-being, should these households have to move to cheaper housing options or go without food or medicine.

Another cumulative impact on environmental justice could arise if the cumulative impact on aesthetic resources changes the character of residential neighborhoods to the extent that current residential areas become dominated by commercial or industrial enterprises. If this transition occurs, low-income populations may face fewer housing options. If sufficiently extensive, these impacts could destabilize neighborhoods. Where neighborhoods contain concentrations of ethnic or non-English-speaking communities, destabilization could diminish the social capital in these communities and the associated economic well-being individuals derive from these social connections.

4.5 CUMULATIVE EFFECTS OF AMENDMENTS TO LAND USE PLANS

Amendments to federal LUPs are described by alternative in Chapter 2, Section 2.3.2.10. Should the plans be amended as described, it may increase the probability that future projects will be proposed to locate their facilities near MSTI (to take advantage of these areas of amended standards). At this time, there is no information on when, where, or what these projects may be and therefore they are not included in any detailed cumulative effects analysis.

4.6 SHORT-TERM USE VS. LONG-TERM PRODUCTIVITY

This section considers the effects of the proposed project, which narrow the range of beneficial uses of the environment. The proposed project and the associated Resource Management Plan and Forest Plan amendments would result in a long-term commitment of resources along the length of the project and at the locations of ancillary features such as the Townsend Substation. The long-term productivity of some soils and forest lands would be lost in localized areas as discussed in the respective impacts section of Chapter 3.

4.7 IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES

This section considers the effects of the project that commit resources and uses of the environment that cannot be recovered if the proposed project were constructed. The proposed project and the associated Resource Management Plan and Forest Plan amendments would result in construction actions that would result in the following irreversible and irretrievable commitment of resources:

- The alteration and removal of vegetative cover and permanent alteration of soil characteristics may be in localized areas where activities such as construction of transmission line structure, access roads, installation of the Townsend Substation, or continual maintenance of the ROW occur.

- The proposed project may result in alteration of habitat in localized areas. Wildlife monitoring is prescribed in the mitigation measures for this project, and this monitoring is intended to accurately characterize the magnitude of the impact and habitat alteration.
- Property values may be impacted in some locations because of the presence of the transmission line.
- Visual resources may be impacted because of the presence of the transmission line on the landscape.
- Where impacts cannot be avoided through design modification, there may be an irreversible and irretrievable commitment of resources related to paleontological and cultural resources.
- Impacts on human health and safety that result in severe injury or death.
- Impacts to quality of life, which, once disrupted, may not return to the way it was before the disruption.

Proposed project alternatives are expected to permanently modify between approximately 71 (Alternative 4A) to 1,139 (Alternative 1A) acres of vegetation. Permanent impacts to soils susceptible to erosion range from approximately 42 (Alternative 4A) to 247 (Alternative 5C) acres. However, after the useful life of the facility, some of that soil and vegetation cover would be restored through mitigation identified in this EIS. The duration of the project on the landscape is currently unknown, with the state certificate being issued in perpetuity but the federal authorizations being issued by BLM and the USFS for 30 to 50 years respectively (with option for renewal). Impacts to aesthetic and natural resources cannot be reversed in several decades. Trees can grow back over a generation, and may ultimately obscure the proposed project, but some disturbances to the landscape may not be reclaimed by natural forces or sufficiently addressed by active reclamation efforts within a generation, and so for most people would constitute irreversible damage.

Many impacts of the proposed project would be transitory or quickly reversible. For example, the labor market probably would adjust quickly and automatically to proposed project-related impacts on jobs and incomes. Similarly, housing markets would adjust to proposed project-related impacts on demand. Some of the proposed project's expected impacts, however, cannot easily be undone or reversed. Economists often consider impacts that are not reversible within a time span meaningful for human societies to be irreversible (Fisher 2000). Some analyses employ a generation, or 50 years, as the relevant time period for an irreversible impact. Those impacts that fall into this category should be undertaken with caution and only after fully accounting for the value of the associated uncertainties and risks (Chavas 2000). The preceding discussion identifies several types of irreversible socioeconomic impacts that might result from the proposed project.